SCIENTIFIC AMERICAN

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Vol. XXXVII.—No. 20. [NEW SERIES.] NEW YORK, NOVEMBER 17, 1877. [$3.20 per Annum. [POSTAGE PREPAID.]

Experiments with the Turkish Bath.

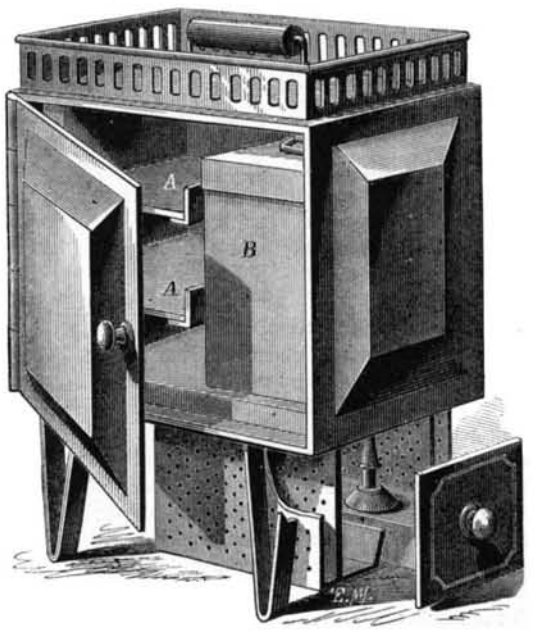
Some interesting observations were related at the last meeting of the British Medical Association, by William James Fleming, M.B. (Glasgow). These experiments were performed by the author upon himself. and consisted of observations on the effect of the Turkish bath at temperatures of from 130° Fah, to 170° Fah., upon the weight, temperature, pulse, respiration, and secretions. The results showed that immersion of the body in hot dry air produced loss of weight to an extent considerably greater than normal, amounting, on the average, to the rate of above forty ounces an hour. This was accompanied by an increase in the temperature of the body and a rise in the pulse rate, with at first a fall and then a rise in the rapidity of respiration. The amount of solids secreted by the kidneys was increased, and coincidently the amount of urea. The sweat contained a quantity of solid matter in solution, and among other things a considerable amount of urea. The most important effect of the bath was the stimulation of the emunctory action of the skin. By this means the tissues could, as it were, be washed by passing water through them from within out. The increased temperature and pulse rate pointed to the necessity of caution in the use of the bath when the circulatory system was diseased.

IMPROVED PORTABLE LUNCH HEATER.

The annexed engraving represents a convenient apparatus for keeping a lunch or dinner warm while being carried from the place where it is cooked to the place where it is to be eaten, and for warming a lunch or dinner quickly, should it become cold.

A box, of rectangular shape, is provided with legs of convenient length. At A are shelves, the ends of which rest upon cleats attached to the box. A narrow space is left at one end of the shelves to receive a cup, B, to contain coffee, tea, soup, or other liquid. The bottom and one end of the box are made with double walls, to form a hot-air chamber for the heated air from the lamp to pass through. The lamp is placed in a chamber of perforated sheet metal, and is secured in place by flanged cleats or angle strips. To the top of the box is attached a handle for convenience in carrying it; and also on the top of the box is attached a rim to form a tray to receive and carry knives, forks, spoons, napkins, and other articles.

This invention was patented through the Scientific American Patent Agency, September 18, 1877, by Mrs. Maria Bradley, of New York city.



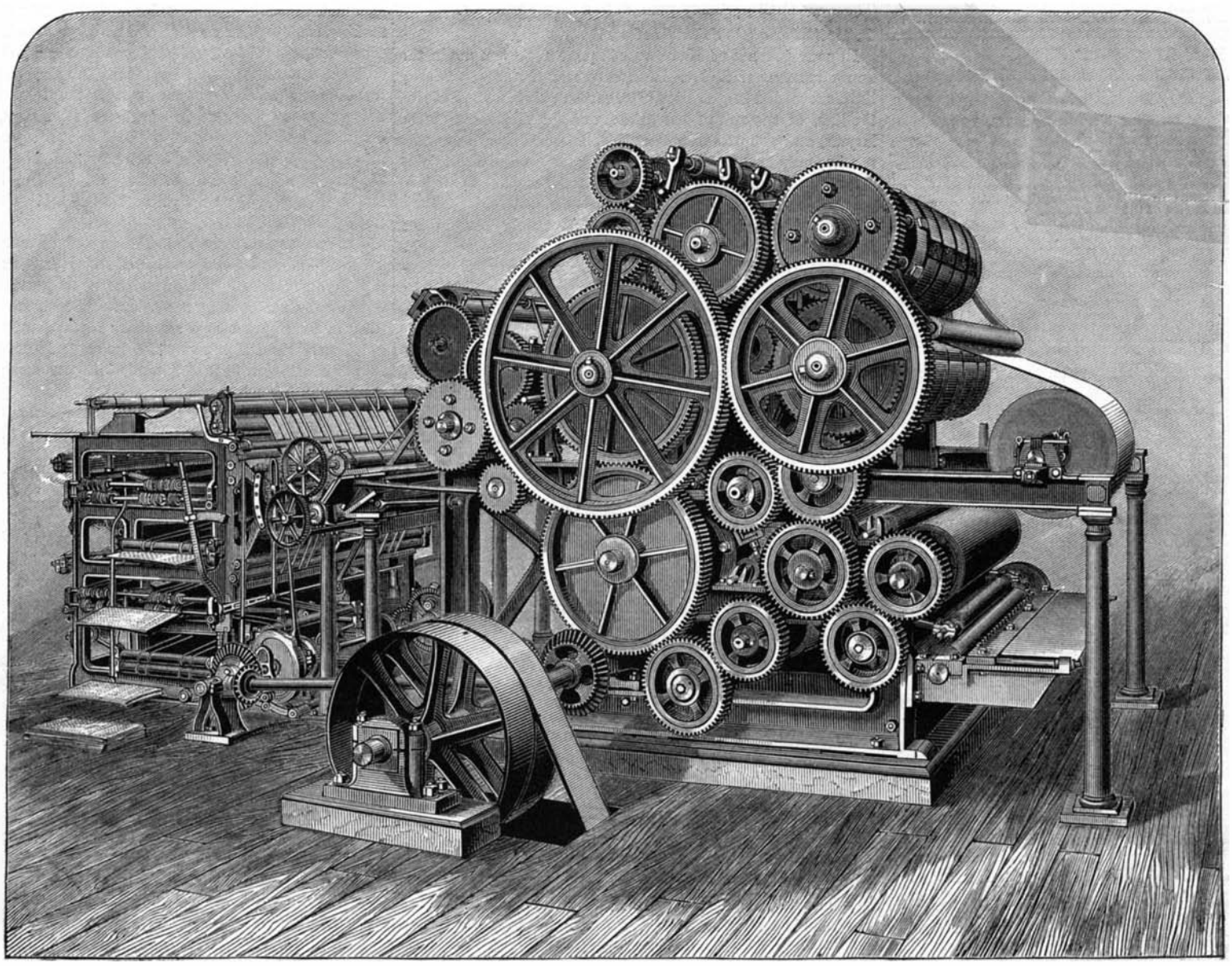
A GERMAN contemporary recommends etching with a preparation of 250 grammes of perchloride of iron, which is allowed to slowly decompose in half a liter of water. The advantage of this preparation is said to be that it has an effect on metals of all sorts without giving off noxious vapors. The object will need constant cleaning with a brush. The solution is rectified with oxide of iron when choked with metal; the etched ground is cleaned with turpentine.

INGRAM ROTARY MACHINE FOR PRINTING ILLUSTRATED NEWSPAPERS.

We illustrate herewith the new Ingram rotary printing press, from which engravings are printed from circular forms. It is the invention of Mr. William James Ingram, M.P., the son of the founder of the *Illustrated London News*. It is now used for printing that journal, from the pages of which we take our engravings.

At one end is placed a roll of paper about three miles long; and the machine is no sooner started than the paper is caught in the first instance by the cylinders immediately above the reel, receiving an imprint of the inner letterpress form; thence it is carried diagonally downward to the picture cylinders which print the illustrations on the other side of the sheet; it is next conveyed to the species of guillotine which cuts each number to its proper size, and being carried therefrom by tapes to the folding machine, this finally delivers a perfect copy of the paper—well printed on both sides, and folded—at the rate of 6,500 an hour. One marked advantage claimed for this new machine is the great saving of time in making ready the illustrations for printing, from the fact that the cylinders are more rigid, and require a thinner "overlay" than any other machine we know. As for the letterpress form, neither "underlaying" nor "overlaying" is required, and the machine is constructed to work without roller lifts or bearers on either form. We may remark in further illustration of its many advantages over the ordinary press, that in the second week it was in use for printing a large issue its average work exceeded that of four of our fastest "two feeders"—a rapidity which may be realized all the more forcibly when we add that, whereas the new machine prints both sides of the paper, cuts each sheet, and delivers it folded, the old horizontal machines simply printed one form in the same time, and did not fold the sheets. There is thus a considerable saving of manual labor, only four men being engaged on the rotary machine, whilst twenty-four men were employed on the four machines. Let it be added that the "Ingram" machine only occupies the space of an ordinary perfecting machine; and little more

[*Continued on page* 306.]



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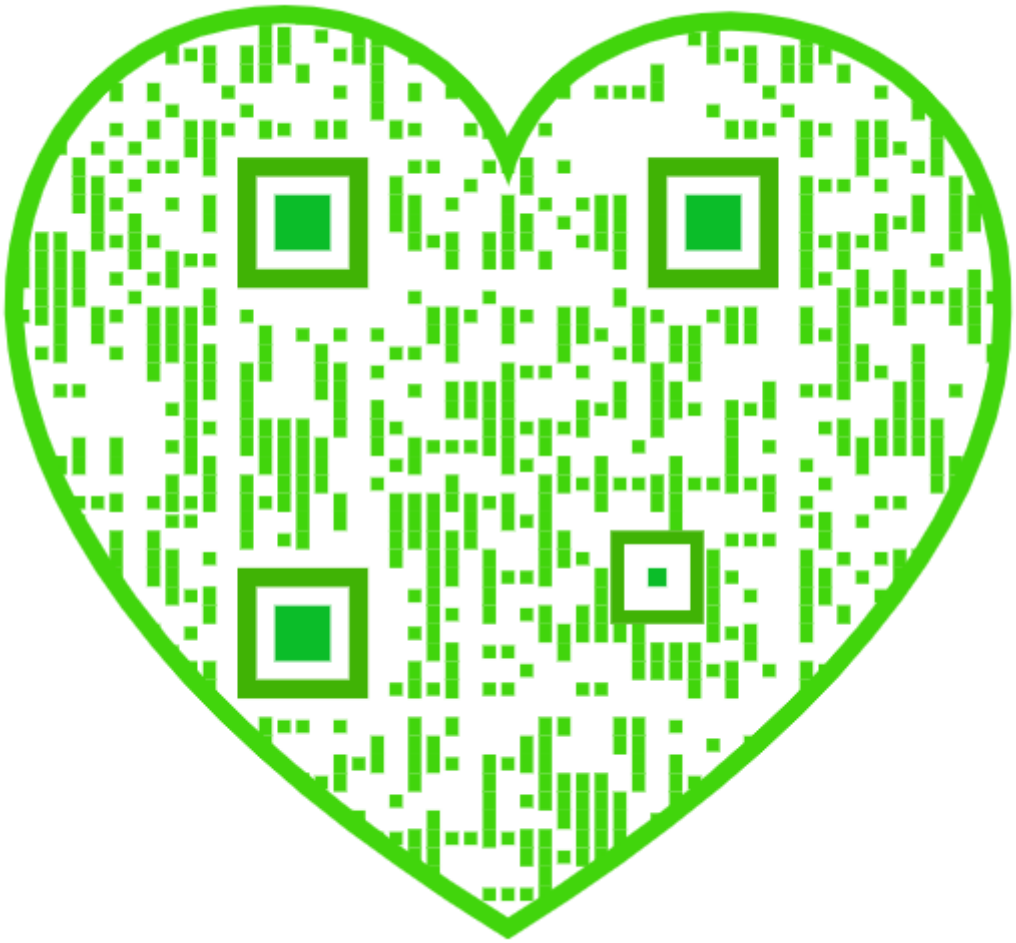

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NEW YORK, SATURDAY, NOVEMBER 17, 1877.

Contents.

(Illustrated articles are marked with an asterisk.)

Ants' habits 313
Asparagus paper 313
Azimuth and polar distance. (12) 315
Band sawing machine, Fay's*.... 310
Beard, causing to grow (33)..... 316
Book notices..... 313
Boring and turning machine*.... 306
Bridge, East River..... 371
Carbon points (51) 316
Castings, making sound (49) 316
Cement, rubber (14).. ..... 3 5
Coal dust as fuel 308
Cobalt, technical uses of..... 307
Eggs, time of hatching (7)..... 315
Franklin relics discovered..... 305
Gilding, bronze powder for (35).. 316
Grinding mill, Harrison's*..... 310
Gun barrel, dark blue (1) 315
Gutta percha capsules..... 310
Ink powder (15)..... 315
Inks and pads, cancelling..... 308
Ink, stencil (16) 315
Iron from steel, etc., (48)..... 316
Iron, to brighten 309
Irons, mixing and melting..... 311
Jewelry, manufacture of..... 308
Ketchup, mushroom 313
Lacquer, iron and zinc (6)..... 315
Law notes..... 305
Lunch heater, portable*..... 303
Massachusetts on the rocks*..... 311
Matches, composition for (18).... 315
Metals, influence of light on 305
Metals, tenacity when heated ... 304
Mucilage, to make (4)..... 315
Orton, Professor James..... 305
Patents, American and foreign 313
Patents official list of 316
Phonetics, graphic*..... 307
Phonograph, Edison's*..... 304
Pipes, tobacco, danger of..... 311
Platinum wire, drawing..... 309
Poison, effects on animals..... 311
Polish, black (4) 315
Printing press, rotary*..... 308
Rust joints in cast iron (11) 315
Skins, curing small (38)..... 316
Stage, mechanical effects (2)..... 315
Strike, cigar-makers'..... 305
Talc mills..... 309
Tin, crystalline surface on (54)... 316
Tobacco, making plug (43)..... 316
Tombs, constructing (36)..... 316
Turkish bath, experiments with. 305
Varnish, imitation shellac (35).... 315
Watch crystal, drilling (40) 316
Water, purification of..... 308
Woad..... 310

TABLE OF CONTENTS OF
THE SCIENTIFIC AMERICAN SUPPLEMENT
No. 98,
For the Week ending November 17, 1877.

I. ENGINEERING AND MECHANICS.—Retort Settings. 6 engs.—The Lowe Gas Process.—Valves for Gas and Other Purposes. 6 engs.—Blasting Jelly and Other Explosives.—The Wren Portable Gas Works. 2 engs.—New Suspension Bridge.—The Howe Truss Angle Block. 1 eng.—The Removal of Sand Bars. Experiments in France upon a new system. By M. CH. BERGERON. 10 engs.—Improved Range Finder. 3 engs.—The Portable Engine of the Future.

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IV. CHEMISTRY AND METALLURGY.—Free Ammonia in Cast Steel. By P. REGNARD.—Platinum Ore from the Ural Mountains. By SERGIUS KERN.—Aconitic Acid in the Juice of the Sugar Cane. By ARNO BEHR.—Nitric Acid and its Salts. By Dr. ADOLPH GEYGER.—Chemical Reagents. By M. W. ILES.—Decomposition of Crystallized Potash-Alum at 100°. By ALEX. NAUMANN.—The Poison of the Cobra de Capello. By A. W. BLYTH.—The Function of Chlorophyll. By R. SACHSE.—Heat in Silver Mines.—The Crystalloids and Colloids of Honey.—Pure Manganese Chloride from Chlorine Residues. By A. PIZZI.—On Sulpho-cyanates in Urine. By R. GSCHEIDLEN.—Relation of Phosphoric Acid to Nitrogen in Urine. By W. ZULZER.—Separation of Sal-ammoniac in Urine. By C. VOIT.—Ancient Specimen of Tin. By A. H. CHURCH.

V. ELECTRICITY, LIGHT, HEAT, ETC.—Bubbles by Heat. By WALTER N. HARTLEY.—Electrosilicic Light. By G. PLANTE.—Carbon Points for the Electric Light By F. CARRE.
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VI. ASTRONOMY.—Star or Star Mist. By RICHARD A. PROCTOR.

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VIII. PHYSIOLOGY AND HYGIENE.—Red Blood Corpuscles. By W. H. HAMMOND, 2 eng.—Differences of Chemical Structure and of Digestion amongst Animals. By F. HOPPE-SEYLER.—Formation of Glycogen in the Bodies of Animals. By J. FORSTER.—The Pancreatic Juice of Herbivora. By A. HENRY and P. WALLHEIM.—Formation and Separation of Pepsin. By P. GRUTZER.—Modifications of Animal Fats. By H. C. BARTLETT.

IX. CHESS RECORD.—Biographical Sketch of Herr Harwitz of Prussia, with Portrait, and Game between LOWENTHAL and himself, with Notes.—Three Problems by W. A. SHINKMAN.—Free Press Problem Tourney Number 3.—Solvers' Tourney.—Solutions to Problems.—Problem from the Page of History.—The Detroit Free Press Tournaments.—Suggestions and Anecdotes.

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A WONDERFUL INVENTION.—SPEECH CAPABLE OF INDEFINITE REPETITION FROM AUTOMATIC RECORDS.

It has been said that Science is never sensational; that it is intellectual not emotional; but certainly nothing that can be conceived would be more likely to create the profoundest of sensations, to arouse the liveliest of human emotions, than once more to hear the familiar voices of the dead. Yet Science now announces that this is possible, and can be done. That the voices of those who departed before the invention of the wonderful apparatus described in the letter given below are for ever stilled is too obvious a truth; but whoever has spoken or whoever may speak into the mouthpiece of the phonograph, and whose words are recorded by it, has the assurance that his speech may be reproduced audibly in his own tones long after he himself has turned to dust. The possibility is simply startling. A strip of indented paper travels through a little machine, the sounds of the latter are magnified, and our great grandchildren or posterity centuries hence hear us as plainly as if we were present. Speech has become, as it were, immortal.

The possibilities of the future are not much more wonderful than those of the present. The orator in Boston speaks, the indented strip of paper is the tangible result; but this travels under a second machine which may connect with the telephone. Not only is the speaker heard *now* in San Francisco for example, but by passing the strip again under the reproducer he may be heard tomorrow, or next year, or next century. His speech in the first instance is recorded and transmitted simultaneously, and indefinite repetition is possible.

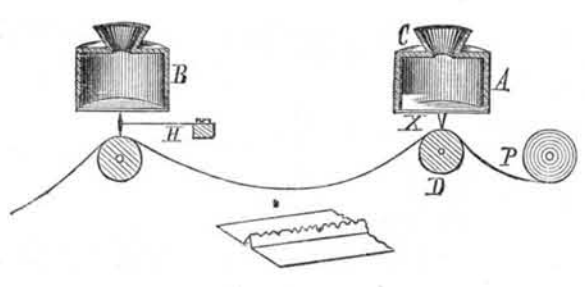
The new invention is purely mechanical—no electricity is involved. It is a simple affair of vibrating plates, thrown into vibration by the human voice. It is crude yet, but the principle has been found, and modifications and improvements are only a matter of time. So also are its possibilities other than those already noted. Will letter writing be a proceeding of the past? Why not, if by simply talking into a mouthpiece our speech is recorded on paper, and our correspondent can by the same paper hear us speak. Are we to have a new kind of books? There is no reason why the orations of our modern Ciceros should not be recorded and detachably bound so that we can run the indented slips through the machine, and in the quiet of our own apartments listen again, and as often as we will, to the eloquent words. Nor are we restricted to spoken words. Music may be crystallized as well. Imagine an opera or an oratorio, sung by the greatest living vocalists, thus recorded, and capable of being repeated as we desire.

The invention, the credit of which is due to Mr. Thomas A. Edison, should not be confounded with the one referred to by us in a previous number, and mentioned in our correspondent's letter. That device is illustrated on another page of this issue, and is of much more complicated construction. Mr. Edison has sent us sketches of several modifications and different arrangements of his invention. These we shall probably publish in a future number.

To the Editor of the Scientific American:

In your journal of November 3, page 273, you made the announcement that Dr. Rosapelly and Professor Marey have succeeded in graphically recording the movements of the lips, of the vail of the palate, and the vibrations of the larynx, and you prophesy that this, among other important results, may lead possibly to the application of electricity for the purpose of transferring these records to distant points by wire.

Was this prophecy an intuition? Not only has it been fulfilled to the letter, but still more marvelous results achieved by Mr. Thomas A. Edison, the renowned electrician, of New Jersey, who has kindly permitted me to make public not only the fact, but the *modus operandi*. Mr. Edison in the course of a series of extended experiments in the production of his speaking telephone, lately perfected, conceived the highly bold and original idea of recording the human voice upon a strip of paper, from which at any subsequent time it might be automatically re-delivered with all the vocal characteristics of the original speaker accurately reproduced. A speech delivered into the mouthpiece of this apparatus may fifty years hence—long after the original speaker is dead—be reproduced audibly to an audience with sufficient fidelity to make the voice easily recognizable by those who were familiar with the original. As yet the apparatus is crude, but is characterized by that wonderful simplicity which seems to be a trait of all great invention or discovery. The subjoined illustration, although not the



actual design of the apparatus as used by Mr. Edison, will better serve to illustrate and make clear the principle upon which he is operating.

A is a speaking tube provided with a mouthpiece, C—; X is a metallic diaphragm which responds powerfully to the vibrations of the voice. In the center of the diaphragm is secured a small chisel-shaped point. D is a drum revolved by clockwork, and serves to carry forward a continuous fillet of paper, having throughout its length and exactly in the center a raised V-shaped boss, such as would be made by passing a fillet of paper through a Morse register with the lever constantly depressed. The chisel point attached to the diaphragm rests upon the sharp edge of the raised boss. If now the paper be drawn rapidly along, all the movements of the diaphragm will be recorded by the indentation of the chisel point into the delicate boss—it, having no support underneath, is very easily indented; to do this, little or no power is required to operate the chisel. The tones of small amplitude will be recorded by slight indentations, and those of full amplitude by deep ones. This fillet of paper thus receives a record of the vocal vibrations or air waves from the movement of the diaphragm; and if it can be made to contribute the same motion to a second diaphragm, we shall not only see that we have a record of the words, but shall have them re-spoken; and if that second diaphragm be that of the transmitter of a speaking telephone, we shall have the still more marvelous performance of having them re-spoken and *transmitted by wire at the same time to a distant point.*

The reproductor is very similar to the indenting apparatus, except that a more delicate diaphragm is used. The reproductor, B, has attached to its diaphragm a thread which in turn is attached to a hair spring, H, upon the end of which is a V-shaped point resting upon the indentations of the boss. The passage of the indented boss underneath this point causes it to rise and fall with precision, thus contributing to the diaphragm the motion of the original one, and thereby rendering the words again audible. Of course Mr. Edison, at this stage of the invention, finds some difficulty in reproducing the finer articulations, but he quite justified by results obtained, from his first crude efforts, in his prediction that he will have the apparatus in practical operation within a year. He has already applied the principle of his speaking telephone, thereby causing an electro-magnet to operate the indenting diaphragm, and will undoubtedly be able to transmit a speech, made upon the floor of the Senate, from Washington to New York, record the same in New York automatically, and by means of speaking telephones redeliver it in the editorial ear of every newspaper in New York. In view of the practical inventions already contributed by Mr. Edison, is there any one who is prepared to gainsay this prediction? I for one am satisfied it will be fulfilled, and that, too, at an early date.

EDWARD H. JOHNSON, Electrician.

INFLUENCE OF HEAT ON THE TENACITY OF METALS.

A very important series of experiments has recently been conducted by the Admiralty at Portsmouth, England, with a view of ascertaining what loss of strength and ductility takes place in gun metal composition when raised to high temperatures, the especial object being to discover whether gun metal would be more or less suitable than cast iron for making such articles as stop and safety valve boxes, steam pipe connections, fastenings, etc., which might be subjected to high temperatures, either from superheated steam or from being placed in proximity to hot uptakes or funnels. The gun metal was cast in the form of rods one inch in diameter, and composed of five different alloys as follows: No. 1. Copper, 87·75; tin, 9·75; zinc, 2·5. No. 2. Copper 91; tin, 7; zinc, 2. No. 3. Copper, 85; tin, 5; zinc, 10; No. 4. Copper, 83; tin 2; zinc 15. No. 5. Copper, 92·5; tin, 5; zinc, 2·5.

The specimens were heated in an oil bath near the breaking machine, and the operation of fixing and breaking were rapidly and carefully performed so as to prevent, as far as possible, loss of heat by radiation. The strength and ductility of the above alloys at atmospheric temperature were as follows: No. 535 pounds, 12·5 per cent; No. 2, 825 pounds, 16 per cent; No. 3, 525 pounds, 21 per cent; No. 4, 485 pounds, 26 per cent; and No. 5, 560 pounds, 20 per cent. As the heat was increased a gradual loss in strength and ductility occurs, up to a certain temperature at which, within a few degrees, a great change takes place, the strength falls to about one half the original, and the ductility is wholly gone. Thus in alloy No. 1, at 400° Fah., the tensile strength had fallen to 245 lbs., and the ductility to 0·75 per cent; the precise temperature at which the change took place was ascertained to be about 370°. At 350° Fah., the tensile strength was 450 lbs., and ductility 8·25 per cent. At temperatures above the point where this change begins and up to 500° Fah., there is little if any loss of strength.

It is scarcely necessary to point out the practical importance of this discovery; 370° is a comparatively low temperature and easily reached under no abnormal conditions in cannon and in many parts of machinery which are now made of gun metal. If specimens of the best alloys of that description are liable to become so seriously impaired in strength by the change, the question of course arises as to what alloys may be substituted for gun metal which shall not partake of its unreliable character.

Various other alloys have been tested during the same series of experiments in order to investigate this, and the subject will be further pursued in other trials. It appears that phosphor bronze, the only metal in the series which from its strength and hardness could be used as a substitute, was less affected by temperature, and at 500° retains more than two thirds of its strength and one third of its ductility. The experimenters suggest however that before adopting

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phosphor bronze as a substitute for gun metal, it should be determined what difference may arise from variations in the process of casting or difference in the quality of the material used, also whether it is possible to harden any of the other compositions without loss of strength.

It is further stated that rolled Muntz metal (copper 62, zinc 38) and copper are satisfactory up to 500° and may be used as securing bolts with safety. Wrought iron, Yorkshire and remanufactured, increases in strength up to 500°, but loses slightly in ductility up to 300°, where an increase begins and continues up to 500°, where it is still less than at ordinary temperature of the atmosphere. The strength of Landore steel was not affected by temperature up to 500°, but its ductility is reduced more than one half.

A NEW AND REMARKABLE STRIKE.

For three weeks past a strike has been progressing in this city which, both in its origination and the manner in which it has been conducted, presents some remarkable features. The striking workmen number about ten thousand, and their trade is the manufacture of cheap cigars, mainly of Connecticut tobacco. There are over 1,800 cigar manufacturers in this city. By far the larger number are small manufacturers, who employ from five to fifty hands in a shop. The present strike is almost confined to the large manufactories, some sixty in number, and which are run by piecework under two systems. Either the hands come to a "shop," or the work is given out to families who live in tenements belonging to the firm. In the tenements the pay averages from $4 to $4.50 per thousand for the cheapest grade of cigars; in the shops the pay for the same kind is $1 higher per thousand. In the latter, however, the leaf is furnished stripped and booked, while the "house workers" have the additional labor of doing this themselves. "Stripping and booking" is worth 75 cents per 1,000 cigars. The real disproportion between shop and tenement work is, therefore, $1.75 per thousand. There is no reason for the distinction, and to equalize the rates is the main object of the strike. Of the 10,000 strikers, about 6,000 are "house workers," and the hardships which it is now sought to obviate mostly relate to the tenement house system. In shops, division of labor exists—in tenements it does not, except so far as different members of a family divide it among themselves. To make clear this distinction it is well to state that, in a shop, the tobacco leaf is first "stripped" by children, who remove the stems. It is then "padded" into "books" of 50 or 100 leaves each, which are dampened. The best leaves are used for "wrappers," or outer envelope of the cigar; the next best for "binders," or inner wrappers; and the small and broken leaves, together with the cuttings and scraps, are cut up by machines for "filling." The "bunch maker" rolls the filling in the binder and places it in a cigar form or mould, where it is pressed into shape. It then passes to the "roller," or, as he is technically called, the "cigarmaker," who encloses it in the "wrapper" and applies the finishing touches. The finished cigars are then handled by the "packer," who selects and classifies them into various grades, according to strength, color, gloss, and other variations. They are then put in boxes and stamped.

In hand work moulds are not used, each cigar being rolled and put together by one man, who must be a skilled workman. The form cigars are the cheapest made.

The revenue laws require that a license should be paid and a bond filed for every place where cigars are manufactured. To make the expense as little as possible, manufacturers who have work done outside hire a block of tenements and put their "house workers" in possession. The hands to obtain work are obliged to live in these tenements. A family occupies from two to three rooms, for which they pay one third more rent than for similar apartments elsewhere; $11 is paid, when $8 would be a fair sum. These families are supplied simply with forms and crude leaves, so that they are obliged to do everything up to the packing, which involves special skill. The "house workers" are almost all Bohemians, and their entire families, even to children as young as five years, work together. The children usually "strip," the husband "bunches and moulds," and the wife, who is generally the most skillful, does the final rolling. A fair week's work for a family of four or five is 2,500 cigars, and to accomplish this they must often work sixteen hours a day. They would earn about $11 per week. If there are three adults working, $15 per week would be a high figure. The tobacco supplied is often poor, fragile, and difficult to handle, and then still fewer cigars per week are made. The "shops" are ill-ventilated, improperly drained, and consumption among the workers is frightfully prevalent. The tenements are, perhaps, a little better where improvements have been introduced; in many instances they are, if anything, worse than the shops. The destitution and physical condition of the "house workers," especially the children, is very great; the mortality among them has frequently caused the Health Board serious alarm.

The manufacturers explain this condition of affairs with the statement that the tenement workers are inferior hands, making the cheapest cigars, and that the competition of Western manufacturers compels them to keep wages down. On the other hand, the manufacturers who have shops only condemn the tenement system in unmeasured terms.

The cigarmakers now demand that $6 per 1,000 be the lowest rate paid either for shop or tenement work, and that the rates on higher grades of cigars be raised to a fair sum. This amounts to the abolition of the tenement system, as it is doubtful whether it would be profitable under the above conditions. The strike first attained prominence among the "house workers," but soon spread to the large shops, until the above mentioned total was reached. Bunchers averaged from $7 to $10, and rollers from $9 to $12, in shops. No intimidation, no coercion was resorted to, absolutely nothing has been done to compel the disaffected to join the movement. The only means adopted, besides simple argument, were the stationing of pickets at the doors of striking factories and tenements, who reasoned with men who came to take the places of the strikers, and if possible induced them to join the union. If the men persist, they are peaceably permitted to accept employment, but no union man will work in the same shop with them, nor can they afterwards join the union except on paying a large fine.

No sooner had the strike been fairly started than an organization was effected. The striking shops and tenements elected delegates proportioned to their numbers, who met and formed the Central Association of Cigarmakers. Of this body an executive committee arbitrates and equalizes prices for the various shops, manages financial affairs, etc. An organization committee organizes each individual shop, making each a perfect sub-organization, controls pickets and matters of discipline. A relief committee collects funds, examines applications for relief, personally investigating the condition of each applicant, and if worthy delivering certificates in proof of authenticity. These certificates when presented to a sub-relief committee are exchangeable for orders on the relief stores. The orders give details concerning the holder and his family, and call for a ration in accordance. An order for a family of six is exchangeable for seven pounds of flour, two pounds of coffee, four pounds of sugar, one peck of potatoes, three heads of cabbage, besides pease, beans, rice, salt, and soap. This is a weekly ration, and one dollar in cash for small expenses accompanies it. A daily ration of meat and bread is given out, the applicant's name being taken from the weekly order and enrolled in a record. For the sick there are special rations of wine, etc., and provision made for a doctor's attendance. All this organization is entirely separate from the trades' unions. People who receive its benefits are not necessarily union members, although all have since joined the unions. But the unions, of which there are three in the city, contribute largely to the support of the organization. Aid is also furnished by unions out of the city, by unions of entirely different trades, by private subscription, but mainly by weekly contributions from hands in factories which have yielded to the strike and in small shops where adequate wages are paid.

A very strong manufacturers' combination is opposing the strike, so that its success is yet problematical. We have entered into the details of the uprising because they are in marked contrast with the characteristics of other strikes of late occurrence. At the time of writing 2,000 families, numbering over 6,000 people, are drawing upon the relief stores, and nearly all of them are in a state of total destitution. Nevertheless there have been no outrages, no immoderate harangues; in fact, were it not for the published accounts in the daily journals, few would know that 10,000 people in in this city were carrying on a great strike.

NOTES OF DECISIONS OF THE COURTS.

In the case of Lane *vs.* Peck, lately decided by Judge Shipman, the complainants sought to restrain the defendants from the infringement of letters patent for a self-closing faucet, which were issued to Nathaniel Jenkins, June 27, 1875, and which had been duly assigned to the complainants. The defendants admitted the infringement; and the sole question before the court was as to the novelty of the alleged invention. The invention consisted in opening a self-closing faucet by means of a quick-threaded screw follower, the threads of which were inclined at so great a pitch that, when the power to turn the screw was removed, the pressure of the water, and of a spiral spring under the valve, forced the valve to its seat, where it was held by the pressure of the water. As self-closing faucets opening by means of a lever, and also by means of a quick-threaded screw, have long been known, the invention in question was the combination of a quick-threaded screw, valve, and spring.

The French patent of Chrétien Morand, dated November 14, 1851, was chiefly relied upon by the defendants as anticipatory of the plaintiff's patent. The Morand device was designed in part to prevent what is called the "water hammer," or the unpleasant sound which is caused by the reaction of the water when the valve is suddenly closed. The Morand faucet was of two parts of an unequal size; the induction way was of a larger size than the eduction way. There were two valves, also of unequal size. The outer valve was in rigid connection with and was turned by a quick-threaded screw spindle. This valve was so connected with the inner one that the inner valve was guided longitudinally, and was forced to its seat by the same rotation of the screw follower which operated upon the outer valve The connection of the inner valve with the spindle was not by means of a swivel joint. Below the inner valve was a spring, which, with the pressure of the water, caused the valves to be closed when the power that turned the screw was removed. By the use of two valves, the body of water lying between the valves formed a cushion, which checked the force of the sound, or of the blow of the water hammer, when the faucet was suddenly closed. Morand stated in the specifications of his patent that, while he preferred two valves, it would be understood that in certain cases he could employ but one. But the manner in which the faucet would then be constructed he did not describe.

It will be seen that the principal elements employed to produce a self-closing faucet, to wit: the screw follower with a quick-threaded screw, valve, and spring: are found in both the Morand and Jenkins patents; but the double valves of Morand, and the general method in which the mechanism of the inner valve and the spring were arranged, with reference to each other and the water way, caused his faucet to be cumbersome and lacking simplicity and economy. It was a contrivance of many parts, and lacked general utility. Jenkins omitted one of the valves, and of course discarded the connection between the two, and made the passage ways for the entrance and discharge of the water of the same size, and connected the valve and the screw follower by a swivel, and generally materially simplified the construction and arrangement of the valve and spring mechanism. He thus made a simple and economical self-closing faucet. He produced the old result of Morand in a more economical and beneficial manner.

The court, in determining the question of novelty, holds that while the invention of Jenkins is subsidiary to that of Morand, yet Jenkins has essentially changed the Morand device in such a manner that, by the change, the thing which is produced is practically a new structure; that the change introduced by Jenkins is not merely formal, but is, to a certain extent, a structural change and modification of the parts of the Morand faucet, which change required inventive and not merely mechanical skill, and required a sufficient exercise of the inventive faculty to justify the grant of a patent. The Jenkins' patent is therefore sustained, and an injunction and an account decreed against the defendants.

PROFESSOR JAMES ORTON.

We regret to announce the sudden decease of Professor James Orton of Vassar College, one of the foremost of American naturalists and geographers. He was on his homeward journey from Bolivia, and was crossing Lake Titicaca to Peru, where he was seized with a malarial fever and died on the 24th of September. He was interred, the *Panama Star and Herald* says, "on a little island within gunshot of the shore in the port of Puno," 130 miles from Arequipa. Professor Orton was born at Seneca Falls, N. Y., April 21, 1830. He graduated at Williams College in 1855, studied theology at the Andover, Massachusetts, Theological Seminary, and was ordained a congregational minister in 1860, after traveling in Europe and the east. Attracted by scientific pursuits he left the pulpit and in 1866 became an instructor in natural sciences at Rochester University. In the following year he took charge of an expedition fitted out by Williams College to explore the northern regions of South America. Landing on the Pacific coast this expedition proceeded to Quito and thence crossed the continent through the valleys of the Napo and the Amazon, discovering in its course the first fossils ever found in the Amazon valley. On his return in 1869 he became Professor of Natural History at Vassar College. In 1870 he published his well known work, descriptive of his South American journey, entitled "The Andes and the Amazon." In 1873 Professor Orton made a second journey across South America landing at Pará on the Atlantic coast and crossing the Peruvian Andes to Lima, from which city he proceeded by invitation of the late Henry Meiggs to Southern Peru, and by way of Arequipa and Puno reached Lake Titicaca. He came home in 1874. About a year ago he went back to South America for the third and last time, to complete the exploration of the great Beni river, which carries the waters of Eastern Bolivia to the Amazon, by way of the Madeira. For some reason he relinquished his purpose and started, as we have stated, for home, when the disease overtook him. Besides "The Andes and the Amazon," he was the author of many other valuable scientific works.

Professor Orton was a brilliant writer possessing descriptive powers of a high order, as the many letters which he has contributed to these columns while pursuing his South American explorations abundantly testify. His last communication was an excellent paper on the "Sugar Interest in Peru" which appeared in our issue of September 15th last. His death leaves a vacancy in the ranks of workers in Science not easily filled, for it is rarely that the qualities of the scientist, the explorer, and the writer are found united in such eminent degree.

Influence of Light on Metals.

We have already noted M. Siemens' discovery of the influence of light on the electrical resistance of selenium, and his construction of a new photometer based on this principle. Recent experiments have shown that light similarly acts upon tellurium, but in less degree. In a note to the Philosophical Faculty of Heidelberg, M. Bœrnstein states that light also affects platinum, gold and silver, and probably all the metals.

The Sir John Franklin Relics Probably Discovered.

Mr. Thomas Barret, mate of a whaling brig recently lost in Hudson's Bay, has, it is reported, discovered proof of the existence of the records of the ill-fated Arctic expedition, which was commanded by Sir John Franklin. The natives have specified exactly where the books, etc., are to be found, so that Mr. Barret is about to organize an expedition to sail from New York in the spring to obtain them. Some years ago Parliament, it is stated, offered a reward of $100,000 for the recovery of these relics, and on the present maintenance of this offer, the sailing of the new expedition will be contingent.

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[*Continued from first page.*]

need be said to prove that it bids fair to effect as great a revolution in the printing of illustrated newspapers as the latest Walter and Hoe rotary machines have effected in the printing of daily newspapers.

We may here quote from Mr. Ingram's specification to the Commissioners of Patents the passages referring to the principal improvements which he has introduced:

"It has been found in practice that 'cuts' or engravings require much more careful inking than the letter press, and that the ordinary inking arrangements, which are found to answer very well for printing letter press, will give but very imperfect work from engravings or cuts. It has also been wellnigh impossible to obtain satisfactory impressions from 'cuts' or engraved plates bent to the sharp curve required to correspond to printing cylinders of the ordinary size.

"In order to overcome these difficulties I considerably increase the diameter of the printing cylinder to which the 'cuts' or engraved plates are to be adapted, so that the curves to which these 'cuts' or engraved plates are bent may be gentler and of longer radius than the curved surface of the other printing cylinder. By this means I am also enabled to place on the same printing cylinder two, three, or more copies of the cuts or engravings, so that while the surface speed of the large and small printing cylinders is the same, the small cylinder, if it contains only one set of stereotype plates for the letter press, will rotate two, three, or more times for every revolution of the large cylinder. The impression cylinder, which acts in conjunction with the large printing cylinder, is also correspondingly increased in size, and rotates at the same surface speed. If desired, the type cylinder may be increased in size so as to be capable of receiving a duplicate set of stereotype plates for the letter press, while the large cylinder will have triplicate or other suitable number of sets of cuts for the engravings. The large printing cylinders will therefore perform two thirds of a revolution while the smaller or type cylinder is making one complete revolution.

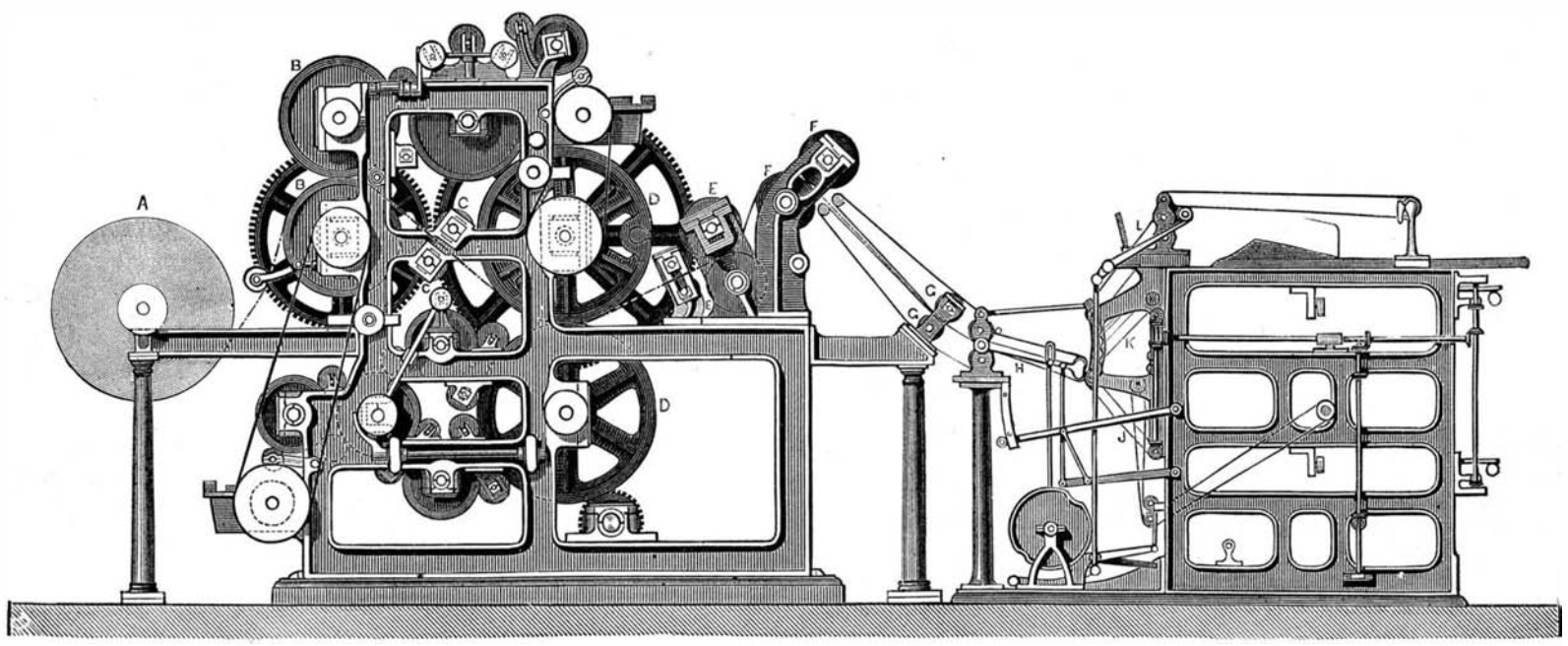
"My next improvement relates to the inking apparatus, which is used in conjunction with the large printing cylinder, and consists in the use of an increased number of inking rollers and distributing rollers, so that the engravings may be more perfectly inked than heretofore. The ink, as is usual, is transferred by a vibrating roller from the ductor or fountain roller to the first distributing cylinder, from which it is taken by two rollers, and is deposited on a second distributing cylinder, to which an endway motion is given by means of any suitable mechanism. The ink is thereby evenly distributed over the surface of this second cylinder, from which it is transferred by other rollers to two other distributing cylinders, in contact with which four inking rollers rotate and take therefrom the ink, which they transfer to the printing surface. In this manner the cuts or engravings are plentifully and evenly supplied with ink, and good impressions are obtained therefrom."

We add particulars of the side elevation view, representing the action of the "Ingram" machine:

A is the roll of paper, containing a length of from two to three miles. B B, the type and impression cylinder for printing the inner form, or type side, of the paper. C C, calendering or smoothing rollers to remove the indentations produced by the impression of B B, so that a smooth surface is preserved to receive the outer form, or illustrated side of the paper, which is printed by D D. E E are cylinders, one provided with a saw-toothed knife, and the other with a corresponding indentation, to perforate the paper between each impression.

F F are rollers for holding the paper securely, to resist the effect of G G, which are called snatching rollers, and, being driven at a rather higher surface speed than the holding rollers, snatch or break the paper at the places where it has been perforated, and form it into separate sheets.

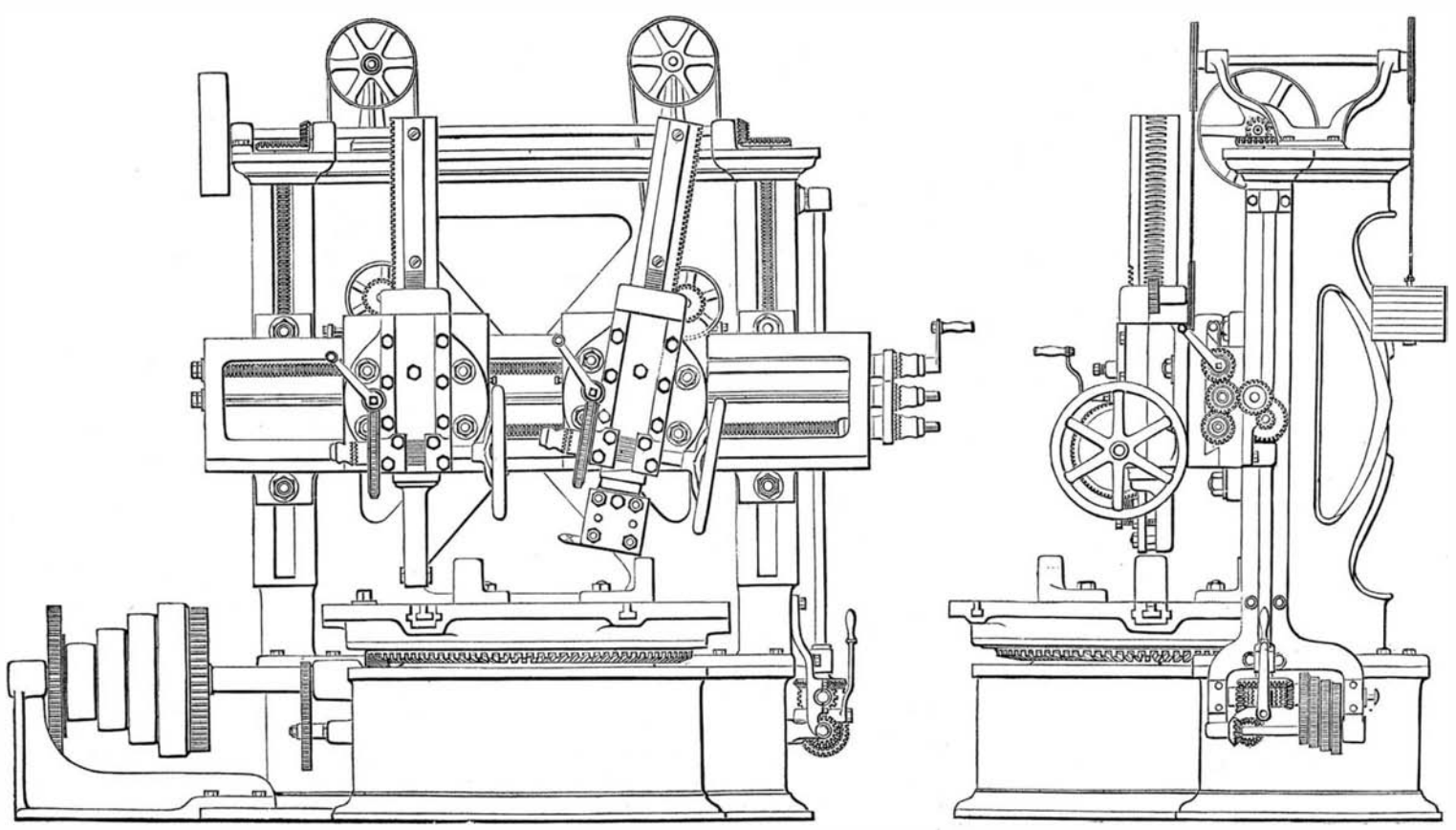
As it is found that machinery for folding newspapers works much better at a moderate speed, in this case it has been arranged in duplicate, so that each folder only works at half the speed of the printing machine. The vibrating arm, H, delivers the sheets alternately to K and J, which are carrying tapes leading to the two folding machines. If the sheets are wanted unfolded, the arm, H, is moved to its highest position and there fixed; it then delivers the sheets to the roller L, and, by means of a blast of air and a flyer, they are laid in a pile on a table provided for them. This change can be made without stopping the machine. Another machine, it is stated, is being constructed embodying further improvements which will make it possible to print two whole sheets and two half sheets of the *Illustrated London News* on the same machine. The size of the page of the *News* is about the same as that of the SCIENTIFIC AMERICAN.



INGRAM'S ROTARY MACHINE FOR PRINTING ILLUSTRATED NEWSPAPERS.

IMPROVED BORING AND TURNING MACHINE.

We illustrate herewith a new combined boring and turning machine, constructed by Messrs. W. B. Bement & Son, of Philadelphia. The headstocks for the boring and turning tools are both mounted on the same carriage, which has a vertical traverse given to it, by means of the screw and bevel gearing driven off a pulley mounted on the horizontal shaft at the top of the frame. The headstocks can be traversed horizontally, or set at any desired angle, and the distance apart of the boring and turning tools can be regulated at will. The tools are fixed, the table on which the work is placed being caused to revolve by the gearing introduced, as shown. The weight of the boring and turning bars is balanced by counterweights passing over pulleys on the top of the frame, and the cutters are fed down to the work by a pinion gearing into the rack on the bar.



BEMENT'S BORING AND TURNING MACHINE.

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GRAPHIC PHONETICS.

In 1875 the French Linguistic Society called for investigations to determine some method which would furnish an objective trace of the phonetic movements produced by the concurrence of the thorax, larynx, lips, tongue, and palate. The object set forth was not merely to discover the part played by each of these organs in producing sounds, but to find how these different motions combined with and followed each other. The matter was referred to Professor Marey who, in conjunction with Dr. Rosapelly, who had already begun similar studies, and M. Havet, of the Society's Commission, undertook a series of experiments. These have proved of considerable physiological importance, as they may lead to the definition of the laws which govern the evolution of language, the discovery of the transitions through which a letter changes in degree, order and family, and subsequently to the determination of the relative force and the succession of air vibrations and of those of the phonetic organs which are called in play in the production of vocal sounds. Of this, the practical result anticipated is the origination of a more scientific method of education for deaf mutes, by conveying to the mind of the latter the necessary instruction through the medium of graphic traces. By performing the motions of the organs called for by these it would follow that the mute would produce exactly the sounds, etc., indicated.

Fig. 1.

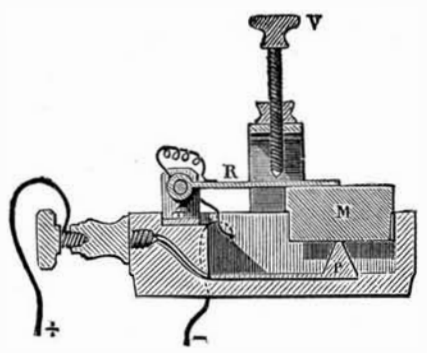
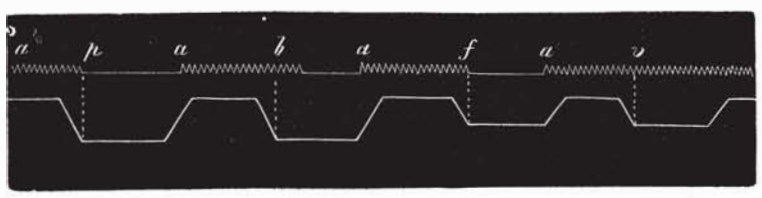


Fig. 3.



In *La Nature* we find the annexed engravings of the apparatus for the exploration and inscription of the vibrations of the larynx, the movements of the lips, and those of the veil of the palate. In speech the larynx emits the fundamental sound, the timbre of which is determined by the resonators, namely, the pharynx, the nasal fossæ, and buccal cavity. Vibrations, therefore, corresponding to a simple sound are produced, which it has been found possible to register by applying laterally to the larynx the apparatus represented in Figs. 1 and 2. This contrivance is analogous to that devised by Professor Marey for recording indications of very rapid movements, and is based on the inertia of a mass elastically suspended. As this mass is capable of obeying only the rapid movements which are communicated to the parts surrounding it, it constitutes a sort of fixed point against which a series of shocks are produced. M is the mass of copper suspended at the extremity of a spring, R. Below the mass is a platinum point, P, which is exactly in contact with the mass, so as to close an electric circuit which follows the path indicated by the wires marked + and −: in the outer portion of this electrical circuit is placed a battery and a Deprez apparatus for rapid signalling. The mass and the point on which it reposes are inclosed in a small light case formed of wood and hardened caoutchouc, so as to obtain insulation of the two ends of the battery circuit, except at the point of contact of M and P. A regulating screw, V, placed near the spring, in the vicinity of the mass, M, limits the movements of the apparatus around the mass which is placed at the center. It will be seen that each vibration of the larynx, on which the apparatus is applied, will cause the separation of the circuit. The Deprez signal indicates each rupture and each closing of the circuit in which it is placed. Its sensibility is such that a great number of signals may be inscribed in a second, and thus all the vibrations of the larynx causing breaks and establishments of the current are accurately registered. In Fig. 3 are shown the vibrations of the larynx corresponding to the vowel, *a*. These disappear when *p* or *f*, in the syllables *ap* or *af*, is pronounced; and persist, on the other hand, when the *v*, in the syllable *av*, is uttered. The same figure shows, besides, the trace of the larynx vibrations, that of the lip movements registered simultaneously.

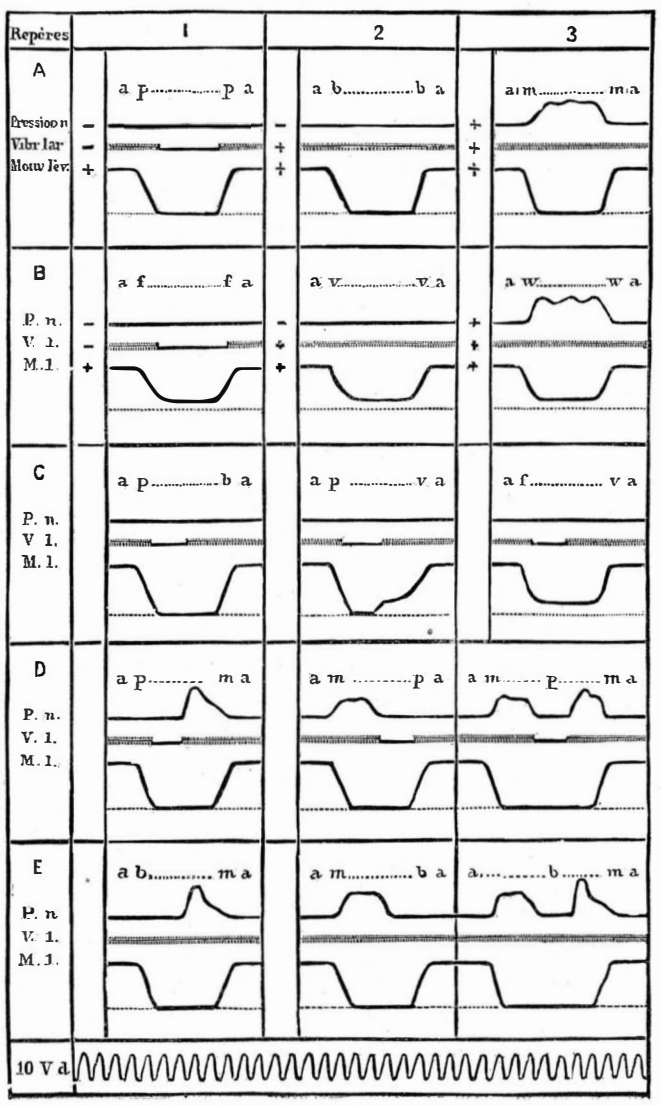
The lips execute vertical movements of raising and lowering and antero-posterior movements in a horizontal plane. During the latter the lips are carried more or less forward. The type of the first kind of movement is observed in the emission of the labial explosive consonants, such as *b* and *p*: of the latter kind, in the emission of the *v*. The apparatus represented in Fig. 4 is designed for the examination of the vertical lip motions. The upper lip is placed in the bent metal arm, *l'*, and the lower lip in the similar piece, *l*. During the elevations of the lower lip the arm which terminates with the portion, *l*, moves about the articulation placed near its middle. It extends the small rubber ring which connects it by opposite end to the upper arm, and so draws toward it the rubber membrane of the drum, T, to which it is connected by a small metal bridge. Air is thus drawn into the drum, T, by the tube, *t*, which also communicates with a drum having an inscribing lever; the pen on which, as the upper lip is raised, makes an ascending line. This will be better understood by examining the broken lower trace in Fig. 3, and in pronouncing the syllable *ab*. The sinuous line expresses the opening of the lips when it occupies the upper horizontal position. It corresponds to their complete closure when it occupies the lower horizontal place. The oblique lines mark the moment of passage from one of these positions to the other.

The movements of the palate, which are of great importance in the articulation of certain syllables, such as *am-ma*, *ab-ma*, cannot be explored except by introducing in the rear nasal fossæ instruments annoying to the experimenter, and, besides, likely to impair the clearness of the sounds produced. Czermack, however, suggested the idea of registering these movements by holding before the nostrils a cold, highly polished mirror. Whenever the veil of the palate is drawn back a displacement of a small quantity of warm moist air occurs, which dulls the surface of the mirror. In order to obtain an inscription of this feeble air current, a small tube is introduced into the nostril, which leads to a drum having, as before, an inscribing lever. By this means, in conjunction with the other apparatus, it was possible to obtain graphic traces simultaneously of the movement of lips, and palate, and larynx vibrations, and thus to determine the problem of studying the duration and succession of the combined movements.

The diagram, Fig. 5, is an example of the graphic result reached. The column on the left indicates the nature of the lines, namely, nasal pressure, vibrations of the larynx, movement of lips. For each curve the same order is observed. Thus the nasal pressure at the top may be normal when noted during the occlusion of the veil of the palate or elevated by the air pressure when the veil is partly retracted. The middle line corresponding to laryngeal vibrations is straight when that organ is mute, and undulatory during the emission of laryngeal sounds, finally the lower line of each series expresses lip movements as already described.

ACCORDING to recent statistics there are in the United States 227 horses to every 1,000 inhabitants.

Fig. 5.



The Technical Uses of Cobalt.

The application of ores of cobalt for blue coloring of glass appears to have been known and practised by the ancient Greeks and Romans, since the presence of this metal has been occasionally detected in ancient glass and porcelain. The general use of cobalt ores for the manufacture of smalt did not occur until about the middle of the sixteenth century, about which time the art was practised in Saxony. The metal cobalt was first isolated and described as a new element by the Swedish chemist Brandt, in 1733. It is closely allied to nickel in many of its properties, and its ores generally occur associated with those of the latter metal. Its chief ores are smaltine, an arsenide of cobalt, iron nickel, some specimens of which often contain as much as 26 per cent of cobalt, cobaltine, or cobalt-glance, a sulph-arsenide of cobalt and iron, and cobalt bloom, a hydrated arsenate of cobalt. The preparation of pure metallic cobalt is one of the most tedious and difficult of chemical processes, and as our purpose here is simply to call attention to the practical uses of the compounds of the metal, its metallurgy need not concern us. The metal has a reddish gray color, and is susceptible of taking a superb polish. It is less infusible than iron, but more so than gold. Like iron and nickel it is magnetic, but does not lose its magnetism by heat. Its specific gravity is about 8·5. In conducting qualities for sound, heat, and electricity it is about the same as iron. It is somewhat malleable at a red heat, when free from manganese or arsenic. It is quite unaffected by air or water at ordinary temperatures, but when intensely heated it burns with a reddish flame. It is only slowly dissolved by hydrochloric acid, but nitric acid or aqua regia dissolves it readily. The solutions of cobalt salts have a fine rosy tint, easily recognizable when once seen. Cobalt has been found to make a very handsome plating upon copper, brass, and iron, rivaling or even surpassing nickel in beauty. Its expense, however, precludes the possibility, at least at the present time, of competing with nickel for this purpose.

Fig. 2.

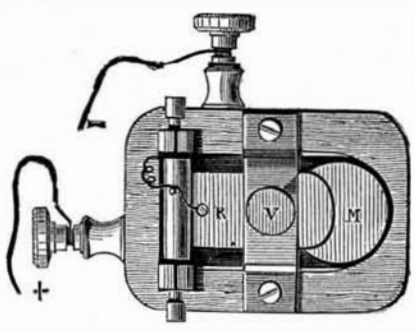
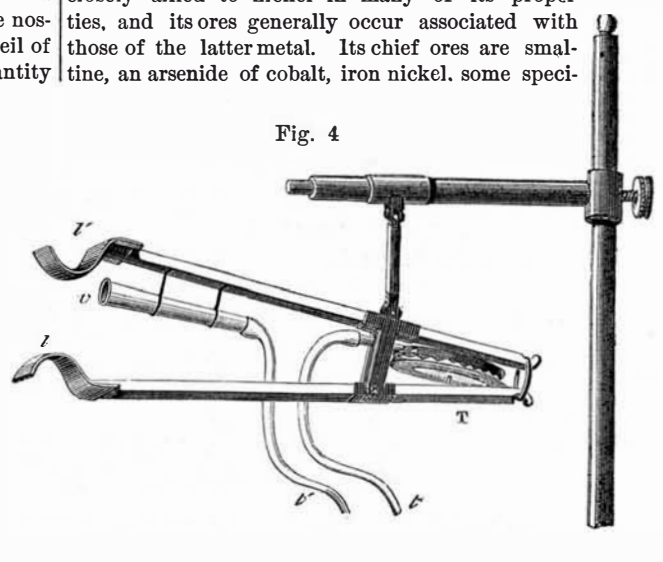


Fig. 4



Compounds of cobalt possess the property of imparting a beautiful blue color to glassy substances at a red heat. The important blue color known as smalt is made by fusing cobaltous oxide with siliceous sand and potassic carbonate in crucibles, and pulverizing the resulting blue glass. This substance was formerly extensively employed for the blue coloration of paper, linen, etc., but its use is now mainly limited to enameling and glazing. A very impure cobaltous oxide is made by roasting smaltine or cobaltine, mixed with siliceous sand, and comes into the market under the name of zaffre. It is also employed for the blue coloration of glass and pottery. Thénard's blue is prepared by mixing alum with a cobaltous salt, and precipitating the mixture with sodic carbonate; or by decomposing the aluminate of soda by means of cobaltous chloride. The precipitate is an intimate mixture of hydrate of alumina and hydrated oxide of cobalt. After being well washed, dried, and heated, the resultant blue pigment bears a close resemblance in color to ultramarine. It is indifferent to acids, alkalies or heat, and is used for staining glass or porcelain, and for oil and water colors.

Cœruleum, another blue color, is a mixture of cobaltous stannate with stannic acid and gypsum. It is also unaffected by heat or by acids and alkalies. Riemann's green is a compound of cobalt and zinc, made by precipitating with sodic carbonate a mixed solution of white vitriol (zinc sulphate) and a cobaltous salt. Cobalt yellow is a mixture of nitrite of cobalt and potas-

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sium, made by passing nitrous vapor through a solution of cobaltous nitrate to which potassic hydrate has been added. A remarkable series of compounds of cobalt with ammonia have been observed and studied by Genth, Gibbs, Frémy and others. The employment of cobalt salts in a laboratory for the detection of manganese, alumina, zinc, etc., by means of the blowpipe, is very important to the analyst. The sensitiveness of cobalt salts to heat and moisture has been utilized in the production of sympathetic inks, which are invisible at ordinary temperatures, but are rendered visible and legible on heating. For this purpose the chloride of cobalt, mixed with a small quantity of gum or sugar, is very well adopted. This "magic ink," as it is called, is rendered visible by holding against a heated surface. It has lately been recommended as very suitable for postal card messages, which would thus be exempt from curious inspection. The sensitiveness of cobalt salt to moisture, which is indicated by a change from blue to a pinkish tinge, has been suggested and employed in the construction of a hygrometer or measure of moisture. In Paris, a late scientific toy is a flower barometer, which is simply an artificial flower of white paper which has been treated with a solution of cobaltous chloride. These flowers when exposed to the sun and dry air become deep blue, but when the air is saturated with moisture they turn of a pinkish hue, thus affording an approximate estimate of the condition of the atmosphere. Landscapes have similarly been painted with cobalt and nickel salts, which on heating develop the characteristic shades of sky and grass. The above facts contain in briefly condensed form the chief features of importance presented by the metal cobalt from a technical standpoint.—*Journal of Applied Science.*

Communications.

Coal Dust as Fuel.

To the Editor of the Scientific American:

Thinking it might interest the readers of your valuable paper, and also call out the experience of some others, I send you the following items of the difference in cost between coal and coal dust as fuel for steam boilers, it being my habit of always keeping a record of the amount of fuel used, kind, cost of same, also number of hours run. This account only includes the actual time run; besides which I have always kept up steam to 40 lbs., all and every night except Sunday.

Boiler is horizontal, 3 feet diameter, 15 feet long, with 24 3 inch tubes running the full length of boiler, grate surface 16 square feet. It supplies steam to the engine, cylinder 9 x 18 inches, steam cut-off at three quarter stroke. It drives an elevator, hoist 40 feet, capable of carrying a safe load of 4 tons, 1 pair of heavy rolls, 1 large skiving machine, 1 McKay sewing machine, 1 No. 2 Sturtevant blower, 1 sand-paper machine, and 30 Howe and Wheeler & Wilson manufacturing sewing machines. It also supplies steam to heat the factory, which is a three story and basement, with 128 large windows, 5 outside doors, and 8 scuttles in the upper story. It furnishes steam to an office heater also. The comparison of coal is as follows.

Amount of coal burned.....	94½ tons.
Cost of coal burned.....	$567.00.
Number of hours run.....	2,698.
Average cost per hour.....	21c. and a trifle over.
Amount of dust burned	133¼ tons.
Bost of dust burned.....	$203.37.
Number of hours run.....	3,088.
Average cost per hour	6½ c.

The coal was used during the first 18 months the boiler was ever used, consequently everything was in the most favorable condition, while at the time I commenced to burn the dust, scale had accumulated to the thickness of at least 1-16 inch.

Another thing, I was allowed much more time to clean the boiler when burning coal, as the business was quite slack, as compared with it since using dust. I find that it takes no more time to fire with dust than with coal, if as much; but it is very dusty work and trying to the eyesight, while the heating surface of boiler requires double the care to keep it free from ashes and soot. The expense incurred in making the change did not exceed $200.

Milford, Conn. WALTER F. SAGE, Eng.

Canceling Inks and Pads.

To the Editor of the Scientific American:

Noticing in the SCIENTIFIC AMERICAN of October 13 a receipt for marking ink for Post Office use, I give those used in my office for the last two years. I have tried printer's and a great variety of other inks, and find this the best. To one ounce of good sweet oil add, for black, an equal volume of lampblack, and mix thoroughly in a mortar. For blue, use Prussian blue in same proportions. For red, use 6 grains aniline red, dissolve in a small quantity of alcohol, say 1 drachm fluid measure, then add 1 ounce glycerin. To make a pad, take a piece of inch board, previously planed smooth, 5 inches square, cut pieces of any heavy cashmere goods the same size, and place them in layers, say an inch deep, on the block, and smear the ink on alternate layers of the cloth, then sew over all a piece of the same cloth, tacking around the edges of the block to hold the outside cloth firm. Postmasters will find the above excellent for post-marking letters. J. M. H.

Silverton, San Juan county, Col.

The Manufacture of Jewelry.

Fine gold, both on account of its higher value and its ductility, being more difficult to work by modern processes than when alloyed with other metals, has been almost universally succeeded by alloys of a lower grade. For diamond mountings and the better order of jewelry, 18 carat gold has found general acceptance, while for jewelry in general, 14 carat is used. Due to the present depression of business, alloys from 4 carat to 12 carat have been extensively employed for cheap ware. According to the relative proportion of silver and copper added in alloying, the yellow or red color of the gold is regulated. Fine gold being taken as 24 carat, 18 carat red gold consists of fine gold, 18 parts; fine copper, 5½ parts; fine silver, ½ part. Total, 24 parts.

The shade more or less red being regulated by the greater or lesser quantity of silver. For yellow gold, to the 18 parts of fine gold, even quantities of silver and copper are added, and the shade regulated by copper. Green gold is made by adding to the 18 parts of fine gold, silver alone; and blue gold, though very difficult to make, due to iron not making an intimate union with gold, is produced by adding 6 parts of iron to 18 parts fine gold. The alloys are melted in a crucible with the addition of borax as a flux, and cast into ingots—either as bars or plates. These are hammered or laminated according to the purpose for which they are intended. The diamond mounter, or jeweler proper (for the factory workman who works after given rules and patterns, and whose whole duty is to solder together the stamped parts that are given into his hands, scarcely merits the name), receives the crude metal and the design, generally in the form of a drawing, and the execution is left to him. We will select a design and follow him in its development, of two pearls and thirty-one diamonds given him. The main points to be kept in view are to show off the stones to the best advantage, and, if they are perfect, to have no more gold than is absolutely necessary, so that their effects may not be marred. It will first be necessary for him to make the "sittings" for the stones. For this purpose he works out a piece of gold about 3-16 inch high and at the bottom 1-16 inch thick. From this he bends the boxes for the pearl and five upper stones. Of these he makes the settings by scalloping them out, first from the top and then from the bottom, and then solders the small frame under them for a finish. The solder consists of gold of a lower grade, which, melting at a less heat, firmly unites the parts between which it flows. Having done this, he next makes the "cluster." Into a piece of gold about an inch in diameter, and ⅛ inch thick, he makes holes just so much smaller than the stones as to allow setting. Next the outer edge of the "cluster" is finished like a setting, and scalloped "bizzle" and frame soldered under. Now he makes the mounting for the other diamonds. A frame like the contour is made, which is scalloped, and upon which a thick plate is soldered, and into which the diamonds are afterwards carefully mounted. The "knife edge wire" is made from gold bent into the shape of the design and filed sharp at the top. The gold band for the enamel is so arranged that it can be secured after all the rest is finished, in order that the entire work need not go through the enameling fire. The small shot are made by melting particles of gold, which thereby assume a globular form and retain it upon cooling. And now all is ready for construction. This is done by placing the pieces upon a flat charcoal, applying borax and small pieces of finely cut solder to the places where the pieces are to be joined, and heating them by means of a gas jet and blowpipe till the solder "runs." After all the soldering has been completed the work is boiled in dilute sulphuric acid, to clean it of oxide and borax, carefully trued with files, all the file marks removed with a scraper and emery paper, and the task is ready for polishing. This is done first by means of tripoli and oil, and afterwards with rouge and alcohol. By means of gravers, rests for the stones are cut in the settings, and the gold securely pressed over their edges, and the brooch is completed. In the manufacture of the so-called "Etruscan ware," the delicate wire ornamentations are all bent into shape first and then soldered on the jewelry, according to the design. The neat fine gold-like appearance is produced by immersing the jewelry for a few minutes in a boiling solution of muriatic acid three parts, saltpeter two parts, salt one part. This eats out the alloy and brings the fine gold to the surface. Since it attacks copper more readily than silver, a finer effect is produced by alloying the gold with an excess of copper. A very praiseworthy attempt has of late been made to reproduce flowers in their natural colors and details; but, due to the amount of labor necessarily expended upon them, they command higher prices than is generally invested by the majority of purchasers. It is sincerely to be wished that they may gain the approval of the public. By the combination of platinum with red gold for seals, rings, and chains, many novel and very effective designs have been produced. In making plain linked watch chains, the links are wrapped about a mandrel having the exact shape that they are expected to assume. They are then cut apart at one end, hung together, and the joints soldered. Oxidized silver, so much in vogue a few years ago, is made by treating silver with ammonic or potassic sulphide. Enamel is a fusible glass melted into cavities in the gold. Niello, lately fallen almost entirely into disuse, is a black composition of gold, silver, copper, and lead heated together, and melted into a design prepared in the same manner as for enamel. The metal is then scraped and burnished, and produces the effect of a drawing in black upon a gold or silver ground.—*Herman T. Wolf.*

The Purification of Drinking Water.

Chief Engineer McFadden of the Philadelphia Water Works, in his recently issued annual report, gives the following information relative to the purifying of drinking water:

Water, though theoretically made up of only two elements, without perceptible taste, color, or smell, is never supplied by nature chemically pure. Analysis proves that it always contains, in a greater or less degree, foreign matter gathered from many sources. It is only where these impurities exceed a certain percentage that they become dangerous to the health of a community, and make a purifying process necessary to fit the water for domestic use.

These impurities may be classified under three general heads:

I. Floating *débris.*

II. Mineral sediment.

III. Organic impurities.

Impurities of the first class are confined mainly to the surface, and are made up of floating wood, leaves, etc. A properly arranged system of screens will arrest them and obviate this trouble.

The second class is made up of such mineral sediment as is derived from the abrasion of rock, and the washing of the different soils forming the river basin. Unless present in very large and unusual quantities, these impurities are seldom injurious to health, but society demands clean looking water, and the manufacturer often requires it; therefore it is well to get rid of this sediment whenever possible.

Subsidence or gravitation is the simplest plan to pursue, but requires a storage capacity of at least one week's consumption, to give the particles time to settle.

It is in the third class of impurities—those derived from organic bodies—that we find the elements most dangerous to the community; and while their removal is of vital importance, they present the most formidable obstacles to the engineer.

The principal source of organic impurities is decomposing animal and vegetable matter, sewage, dissolved fertilizers, waste from manufactories, etc. These matters remain in suspension until decomposition has removed so much of their volatile natures that the mineral components can sink, but their really dangerous elements frequently so unite chemically with the water that no artificial system of filtration can separate them, and under the guise of pure limpid water they convey the seeds of disease to the consumer.

Subsidence will only partially remove organic impurities; oxidation, by exposing the water in thin sheets to the action of the air, as in running it over weirs, is beneficial; but even an elaborate and costly system of filter beds will not elimi nate all those deleterious particles held *in solution* by the water.

The only true method of furnishing pure water is to maintain the purity of the source of supply, by diverting from it as much as possible, all sewage, manufacturing refuse, etc. Economy and common sense should teach us that it is false in principle, to first pour all manner of filth into our water supply and then attempt to get rid of it by costly and seldom efficient processes. The advice of an eminent hydraulic authority is: "If any water intended for domestic purposes is found to be charged with organic matter *in solution*, the very best plan of treatment is *to let it alone*, and take the required supply from a purer source." The next best plan, when we have no available purer source, is to so perfect the system of sewers—the most fruitful sources of dangerous organic impurities—that they discharge their contents as far as possible from the stream from which we derive our water supply.

A very brief sketch of the methods of artificially purifying water for the use of a community may not be out of place.

Evaporation and the use of chemicals, though really the most effectual, cannot be applied economically to a large public supply. Simpler and cheaper methods must be relied upon.

Carbon, prepared in large plates, and so placed that the water must percolate throught it, especially reacts on all organic matter, but when the demand is heavy this process is very expensive, owing to the large area of filter made necessary by the slow rate of progress of the water through the carbon plates, 3,330 square feet of the *most porous* being required to supply 1,000,000 gallons of filtered water per day,

In England *magnetic carbide*, made by roasting hæmatite iron ore with granulated charcoal, is used in layers of from 2 inch to 12 inch, in a sand filter bed, and is said to give wonderful results in removing organic matter.

Infiltration basins are used in a number of our towns and cities. These are simply galleries excavated in the porous margin of a lake or river, or in water-bearing sand formation, as at Brooklyn. These galleries are sunk below the water level, and are supplied by percolation. They are usually formed of two side walls, say 8 feet apart, arched over, and of a length commensurate with the demand. The amount of water furnished by them depends on the porosity of the sand and gravel beneath and around them, and the head of water under which the filtration is maintained. When the location is favorable, and the volume required not too great, they are simple and effective.

Filter beds purify the water by passing it downwards through intercepting strata of sand and gravel into a clear water basin beneath, from which it is supplied by pumpage to the consumer. They are much used in England and on the Continent, but their first cost and the constant expense of maintenance have discouraged their use in this country.

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The requirements of an efficient sand filter bed may be briefly set down as follows, quoting from the most successful and economical practice:

Kirkwood, in his "Report of the St. Louis Water Commission," recommends as of vital importance to the successful working of a filter bed, and as the first step in the system, the formation of a subsiding basin sufficiently large to hold at least one whole day's consumption of water, thus getting rid of the grosser particles by gravitation; this makes the filtration more economical, and is useful in time of flood and for storage.

The filter beds themselves are usually located at some convenient point on the river bank, or even in the river, if sufficiently protected from floods and from ice, but the great area required for a large supply, and the consequent expensive nature of the protecting works, renders the latter or river plan unadvisable to say the least.

The filter area is subdivided into beds averaging 250 by 150 feet each, and should be not less than 12 feet deep. The sides and bottom must be made impervious by puddle clay or concrete. There are many plans of arranging the interior of the filter bed, but perhaps the best and most economical is one in which the entire floor area of each individual bed is covered with ranges of small brick piers placed a short distance apart, and sufficiently high to form a storage basin for clean water. Upon these piers rests a flooring of rough flagging laid with open joints, and this flagging supports in turn the layer of cobble stone, coarse and fine gravel and sand, through which the water must pass by percolation. When the water flows into the filtering bed from the subsiding basin, all its impurities, except those in solution, are intercepted, and remain on the surface of the sand stratum which forms the uppermost of the filtering strata. The finer this sand the more perfect the filter, but at the same time the slower its action. The deposit of impurities on the sand clogs the filter, and must be removed at intervals of from one to eight weeks, depending on the condition of the water to be filtered. It is to make possible this cleaning process, without stopping the supply to the consumer, that the filter is divided into independent beds, but this at the same time requires a surplus area sufficient to keep one or more beds constantly out of service.

Filter beds should be covered over, to protect them from ice in winter and the heat of summer, which latter especially, acting as it would on shallow and still beds of water, would render the supply unpleasantly warm, and promote vegetable growth in many objectionable forms. Experience has proven that filtered water must be used at once. Unless kept protected it soon spoils, much more readily than turbid water.

Humbar, Kirkwood, and other hydraulic authorities all unite in saying that, to be cleansed of its impurities and made potable, water should not pass through the filter bed at a more rapid rate of *descent* than six inches per hour, or twelve feet per day, and in this simple fact lies the expensive feature of the system, for, to purify 1,000,000 gallons of water per day, requires, at the above rate, 13,500 square feet of filtering area; and as the *present* maximum demand of Philadelphia is 75,000,000 gallons a day, we should need more than 23 acres of filter beds, without counting the surplus area required for cleaning.

The above is a mere outline of the cheapest form of a sand filter. The actual cost of a perfect system of subsiding basin filter and clear water basin will vary with the nature of the site, the material, and the volume of clear water required. The constant expense of attending these basins is likewise a serious item, not to be lost sight of.

Dr. Medlock, of Amsterdam, strongly advocates the use of iron as a purifying agent. In experimenting in the canals of Holland, where the water is very impure, he found that iron gratings and strips of iron placed in the weirs reacted very energetically on water containing ammonia, or matter capable of yielding it, the organic impurities being precipitated by contact.

Talc Mills in St. Lawrence County.

Among the great variety of minerals found in this country there is one which is fast becoming an important article of commerce. The mineral referred to is a hydrated silicate of magnesium known as talc. It occurs in foliated masses, has a soapy feeling, is fibrous but not elastic. Large beds of this mineral are found in various sections of the county. It is quarried, broken into small pieces and ground by means of attrition mills and bolted similarly to flour. It is used in the manufacture of writing paper, fifty per centum of the mineral with fifty per centum of cotton making a fine paper. Being, like asbestos, fireproof, it is used largely in the manufacture of roofing paper. There are at present three talc mills in the county, which are "turning out" daily about fifteen tons of ground material.—*Utica Herald.*

Drawing Fine Platinum Wire.

M. Gaiffé states that microscopic examination of very fine platinum wire shows that the latter always breaks during drawing at points where no sign of injury exists before the wire is put through the draw plate. After drawing, however, spots appear on the metal surface which look like impurities. M. Gaiffé suggests that these are due to particles of dust which adhere to the metal as it is drawn, and which cut into it during the operation. By carefully excluding dust he has succeeded recently in drawing wire $\frac{1}{1170}$ inch in diameter with great ease, and he considers that with finer plates much finer wire can be produced.

Mixing and Melting Irons.

The foundryman cares little or nothing for a chemical analysis of iron, which merely shows the exact amount of different impurities it may contain; but the question that the foundryman asks, is: What irons can I work, and how can I mix them so as to produce a good, clean, strong and *cheap* casting? This is a question that it is almost impossible to answer, as it is impossible to give a complete vocabulary of all the impurities which iron may contain, with their effect upon the iron in different proportions, as these proportions may be varied in remelting and produce different results; and even if it were possible, the foundryman does not wish to go the trouble of making a chemical analysis of every lot of iron he gets in, to ascertain its impurities and to keep track of how it may be mixed with some other lot of iron. Little can be told by looking at an iron in the pig, whether it will run hard or soft when remelted and run into castings, or whether it will mix with another brand of iron. The foundryman, or an expert, may by actual tests become acquainted with all the iron and ores used in a certain locality, and, by looking at the iron in the pig, tell very nearly what it will do when run into castings; but the best expert in the country can tell little or nothing about an iron that he has not been accustomed to working, and he will often be deceived in those he has been accustomed to, by merely looking at the iron in the pig. True, he may make a good guess, and he may tell whether an iron will run extremely hard or soft, but that is all that can be told by the looks of the iron in the pig.

It is impossible to qualify the various kinds of pig iron brought into the market by local terms and marks. It would not, after all, be of any use, because the furnacemen may change their ores or their mode of charging the stock, and change the product of the furnace from a No. 1 iron to No. 2, or even No. 3 iron, which makes a great difference in its application in founderies; or a furnace may change its quality of iron without any change of the ores, and without any apparent cause for the change in the quality of iron. When operating at Lewisburg, Pa., last spring, I found a lot of pig iron that was made at the Dry Valley Furnace, Pa. This iron, when remelted and run into a cylinder head that was nearly two inches thick, was so hard that it could not be drilled, yet the iron in the pig was of a dark gray color with a large open crystal, and to all appearance was a No. 1 soft foundry iron. This iron was made from the same ores that the furnace had been using for years. In making a No. 1 foundry iron, no change had been made in the mode of stocking the furnace, and there was no apparent cause for the change in the quality of iron. This furnace, after it had been in blast for a short time, got to working so badly that it became necessary to blow it out. It was then found that, when putting the furnace in blast, it had scaffold on one side, which was the cause of the hard iron. If a blast furnace, with the fire only on one side of it, will change the nature of iron as this furnace did, then a cupola, with the fire or the blast all on one side of it, will change the nature of iron when remelted. I have seen two cupolas melting the same iron, and one produced good soft, strong castings, and the other produced hard or brittle castings. I have always found that the cupola that produced the hard or brittle castings either had the blast all on one side of it, or that the fire was not burnt up evenly, and that the stock was not charged regularly.

Cast irons admit of a division into three classes and seven grades. The three classes are: the red-short, the cold-short, and the neutral iron. The seven grades are the seven qualities or seven numbers of iron, as No. 1, No. 2, or No. 3. Red-short iron is an iron that has no strength when red-hot, and has a great deal of shrinkage. An extreme red-short iron will shrink as high as one fourth of an inch to the foot. Red-short iron, when used for casting pipe on their end, will cause the body of the pipe to shrink down and leave the bowl of the pipe before the iron has thoroughly set; and when used in other castings, such as grate bars, it will tear off and form cracks in the corners while hot: it will cause chill cracks on the tread of a car wheel, but they are not deep and do not injure the wheel. Red-short iron may be either hard or soft, and is liable to go to extremes either way. It never breaks from shrinkage when cold.

Cold-short iron is an iron that has no strength when cold, and has very little shrinkage; it will resist very little strain, and if the patterns are the least bit out of proportion the casting will break from shrinkage after it is cold; it will cause stove plates to crack under the sprews. Cold-short iron may be either hard or soft, and is liable to go to extremes either way; but it never breaks from shrinkage when hot.

Neutral iron is an iron between the extreme red-short and cold-short irons; it is made by mixing the red and cold-short irons together, A neutral iron is the best iron for foundry purposes, and furnacemen who make a business of manufacturing foundry iron make it a point to mix their ores so as to make as near a neutral iron as possible. Yet in some localities one ore may be cheaper than another, and it may be used to excess, which may make an iron inclined to be either red-short or cold short, yet not extreme either way. The foundryman that is using three different brands of iron may find at times that he has two brands of iron inclined to be cold-short, and one brand inclined to be red-short. If these three irons are mixed in equal proportions they will make a casting inclined to be extreme cold-short. Yet one fourth of the two brands and one half of the third brand, mixed together, may make a neutral iron and a good strong casting; or by leaving out one of the brands, and using one half of each of the other two brands, the same results may be attained. The only practical way to ascertain whether an iron is either red-short or cold-short is by actual tests in mixing and melting the iron in different proportions, and testing the strength and shrinkage. A neutral iron should not shrink more than one eighth of an inch to the foot. Stove foundrymen should be careful to use as near a neutral iron as possible, and to change their brands of iron as little as possible; as the changes of iron often change the shrinkage, and will make trouble in mounting the stoves when much odd plate is kept on hand. When new brands of iron are introduced, test bars should be made to ascertain the shrinkage, and the different brands of iron should be varied so as to keep the shrinkage as near alike as possible.

The same theory may be followed in mixing irons to make a soft iron, thus: three brands of irons, mixed in equal proportions, may make a hard iron, while any two of the same brands, mixed in equal proportions, may make a soft iron. Tests were made last fall at Perry & Co.'s stove works in melting the three brands of iron, namely: Crane, Hudson, and Jagger. These three irons were melted at the rate of fifteen per cent of Hudson to eighty-five per cent of Crane and Jagger together. This mixture made a hard iron. One third of each brand was then melted together, and made a hard iron. One half Hudson to one fourth Crane and one fourth Jagger were then tried, and the result was a hard iron. The Hudson and Crane were then tried together—one half each—and made a good soft iron. The Hudson and Jagger were then tried together—one half each—and made a good soft iron. The Crane and Jagger were then tried together—one half each—and made a hard iron. Thus the Hudson would neutralize either the Crane or Jagger separately, but would not neutralize them when put together in any proportion.

Iron will combine with almost all of the sixty-four known elements; and these elements, combined with irons in different proportions, will destroy the affinity of one brand of iron for another; and foundrymen, in mixing their iron, will generally use equal proportions of all the brands of iron that they are using; thus one half, one third, or one fourth of each brand. If the castings come hard, they will reduce the No. 2 and increase the No. 1 iron; and I have often seen foundries that were using all No. 1 iron, that were still troubled with hard iron. This was because they were using irons that had no affinity for each other, and would not unite so as to form a homogeneous iron; and throwing out the No. 2 iron gives only a temporary relief by the excess of carbon in the No. 1 iron, overcoming the non-affinity of the irons; and if the No. 1 iron happened to be a little poorer, one day than another, the iron was hard and uneven. I have often seen foundrymen that had one brand of iron in their yard that they had had on hand for years, and could not use it; and perhaps the next foundryman that I would meet would be using that same brand of iron, and could not get along without it. This was because the one foundryman was using other iron as a mix that had an affinity for that particular brand of iron; or the two foundrymen might be using the same iron as a mix, and mixing them in different proportions, which produced different results. Two poor irons can often be mixed together so as to make a good iron; as is the case in mixing the extreme red-short and cold-short irons, which forms a neutral iron that is superior to either the red-short or cold-short irons for foundry purposes. In mixing irons, I should recommend mixing them, and varying the mixture by the local brands or marks, and not by the numbers of the iron. To make a good iron, at least one third of No. 2 iron should be used; and if all No. 2 irons can be used and make a soft iron, they will make a superior casting to all No. 1 iron. In melting iron I should recommend melting it hot, and as fast as possible. A quantity of molten iron should be kept in the cupola, or in a large ladle, so as to give the different brands of iron a chance to mix. In most all the foundries at Wheeling, West Va., the cupolas are never stopped in from the time the blast is put on until the bottom is dropped. A large ladle is set on trestles in front of the cupola, in such a manner that the iron can run into it from the cupola, and be poured out into the smaller ladles at the same time. The iron is all run out of the cupola as fast as it is melted, and is mixed in the large ladle. I think this is a good way of mixing irons.—*From the Founding of Iron, by Edward Kirk.*

To Brighten Iron.

The following method of brightening iron, which appears suitable for some of the less important parts of large clocks, is recommended by Boden. The articles to be brightened are, when taken from the forge or the rolls, in the case of such articles as plate, wire, etc., placed in diluted sulphuric acid (1 to 20) where they remain for about an hour. This has the effect of cleansing them, and they are washed clean with water and dried with sawdust. They are then dipped for about a second in commercial nitrous acid, washed carefully, dried in sawdust, and rubbed clean. It is said that iron goods thus treated acquire, without undergoing any of the usual polishing operation, a bright surface having a white glance. Care should be taken by any one using the nitrous acid not to inhale the fumes.

PACKING paper may be made watertight by dissolving 1·8 lbs. of white soap in 1 quart of water, and in another quart 1·8 oz. of gum arabic, and 5·5 of glue. The paper is soaked in the mixture and hung up to dry.

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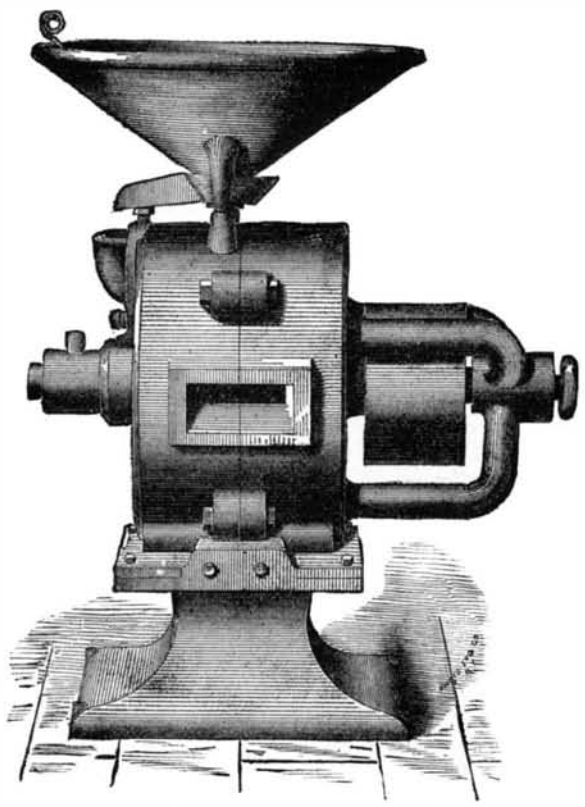
NEW STANDARD LIGHT AND MEDIUM GRINDING MILLS.

In last week's issue we gave illustrations of a portable grinding mill manufactured by Edward Harrison, of New Haven, Conn., in which was shown an improved heavy 20 inch mill, with which were combined pedestal and dressing frame. In the annexed engravings we present two other patterns of mill by the same manufacturer, also embracing bases and dressing frames. The bases, however, are here cast separate from the mill cases, and are attached to them by bolts. They are thus adjustable, and obviate the necessity of frames or foundations, while the dressing frames enable one person to handle the heavy parts of the mills, in which the burrs are encased for the necessary purpose of dressing.

Fig. 1.



The mills illustrated, in common with all produced by the above named manufacturer, have burr stone grinders set in a vertical position and driven at high speed. They are respectively known as the new standard light and medium 20 inch mills. The grinding surface of the light mill, at 1,200 turns per minute, is claimed to be equal to one quarter more than an old style 48 inch run at 175 revolutions per minute. The grinding capacity per hour is from 6 to 40 bushels, and the weight 700 lbs. Fig. 1 shows the mill (either light or medium) with base attached, and Fig. 2, the same open for dress.

A large number of patented improvements are embodied, notably improved side hangers, duplicate discharge spouts, safety bridge trees, adjusting burrs, large oil cup, self-cooling step, besides a new safety spring box and set lever, which permits foreign substances to pass through without damage to the faces.

The grinding surface of the medium 20 inch mill, at 1,300 turns per minute, is equal, it is claimed, to one half more than an old style 48 inch run at 175 revolutions per minute. The grinding capacity per hour is from 9 to 60 bushels, and the weight 1.050 lbs. The larger mill of the two occupies a floor space of 2 feet 6 inches by 4 feet 3 inches.

In our previous article we reverted to the advantages claimed for the system of milling peculiar to these machines. It embodies vertical burrs, rigid runners, and high speed, producing large grinding surface and capacity. The construction is also substantial and durable. For further particulars address the manufacturer, Mr. Edward Harrison, No. 135 Howard Ave., New Haven, Conn.

Woad.

Woad is an annual which is cultivated in Europe for dyeing purposes. It furnishes a beautiful yellow color, which is specially present in the tops of the flowers. The plant comes into commerce in the form of dried bundles. M. Chevreuil has found in it a coloring matter to which he gives the name of *lutéoline*. A decoction made during a quarter of an hour, with a portion of the terminal leaves mixed with pods of the woad and ten parts of boiling water, deposits, when cool, according to M. Chevreuil, flakes of a slight olive brown yellow, which are formed of luteoline, of a crystallizable white matter, an azote matter, oxide of iron, lime, and silex. When the decoction is filtered it is a reddish yellow. It has a disagreeable and peculiar odor, with a sweet bitter taste. It only affects glue slightly, and is acid with sunflower paper. To these characteristics Chevreuil adds the following: It contains sulphate of lime and chloride of calcium in small quantity, and a great deal of soluble salts with a lime basis. Potash changes the color from golden yellow to a greenish shade. Baryta gives a flaky precipitate of a fine yellow. Alum gives a slight yellow precipitate. The hydrochlorate of protoxide of zinc, and especially the acetate of lead, give a more abundant yellow precipitate. The precipitate which is formed by the acetate of copper is a red approaching to green. The sulphate of protoxide of iron colors it an olive brown, and only leaves a slight brown precipitate. Sulphuric acid concentrates the color in red and precipitates some flakes; when the acid is weak it only roils it.

Nitric acid without precipitating darkens its color. Oxalic acid precipitates the oxalate of lime, and the filtered liquid is of a very pale yellow. Acetic acid without precipitating weakens its color, but much less so than oxalic acid. The watery solution of iodine produces nothing remarkable. A little chlorine changes the color red and precipitates flakes. If an excess is exhibited the red disappears, and the liquid changes to yellow. The luteoline, the coloring matter which M. Chevreuil has extracted from the woad, can be sublimated in needles; the largest are transparent and of a light yellow; the smallest, as seen on the surface of the glass where they condense, seem of a deeper yellow and have a velvety appearance. Its reaction on litmus is rather acid than alkaline. It is very soluble in water, and although it scarcely colors this liquid, it gives it the property of dyeing silk and wool (which have been impregnated with alum, and which are put into it at a slightly elevated temperature) a fine greenish yellow. It is soluble in alcohol and in ether. A watery solution of potash colors it a splendid gold yellow, which gradually changes to greenish yellow, then russet, by absorbing oxygen. The solutions of baryta, strontium, lime, and ammonia, act in a similar manner.

The acetate of lead, alum, and the acetate of copper precipitate its watery solution yellow. The sulphate of peroxide of iron precipitates it an olive brown. Concentrated sulphuric acid developes a yellow color which approaches red rather than green.

Gradually red flakes are produced. The concentrated nitre acid, in which it is diluted, will dissolve it; the solution is of a greenish-orange yellow; it precipitates by water. The volatility of the coloring matter and its resistance to the action of concentrated acids place it among the most stable substances of this order. M. Chevreuil has found qualities in it very similar to the coloring matter of quercitron and rosewood. By applying his process to the decoction of woad, M. Preisser obtains a clear yellow liquor, which, on cooling, throws down a large quantity of yellowish white scales; large yellow scales are obtained on boiling with some drops of chromic acid; they are similar to iodide of lead. The yellow matter is the luteoline; it is presented in the shape of white scales, which are soluble in water.

Gutta Percha Capsules.

A useful purpose to which benzole may be put as a solvent is in dissolving the little scraps and odd pieces of gutta percha tissue, which in the ordinary course of business will accumulate, and which are too frequently thrown aside as waste and useless. If these be dissolved by the aid of a gentle heat, so as to form a moderately thick fluid, and then vermilion or other pigment added, both for the purpose of coloring the solution and giving it a greater body, a preparation is obtained capable of producing a uniform and a very superior film. The purposes to which such a solution may be applied are various, but one in particular suggests itself, namely, as a capping for bottles. In thus employing it the solution may either be brushed over the top, or better still, the top of the bottle may be dipped into it, as bottles are dipped into sealing wax, and then put aside to set. The gutta percha capsule thus obtained is impervious to air, water, oil, spirit, and indeed most liquids, tears cleanly off when required, and has the further great advantages of cheapness, simplicity, and neatness. No better or neater finish could, we think, be given to liquid patent and proprietary medicines than a gutta percha capsule prepared to this manner.—*Chemist and Druggist.*

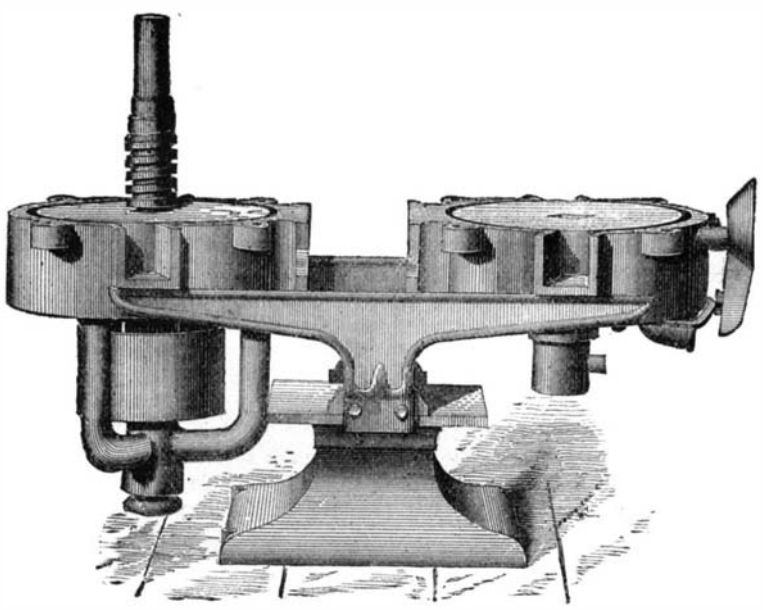
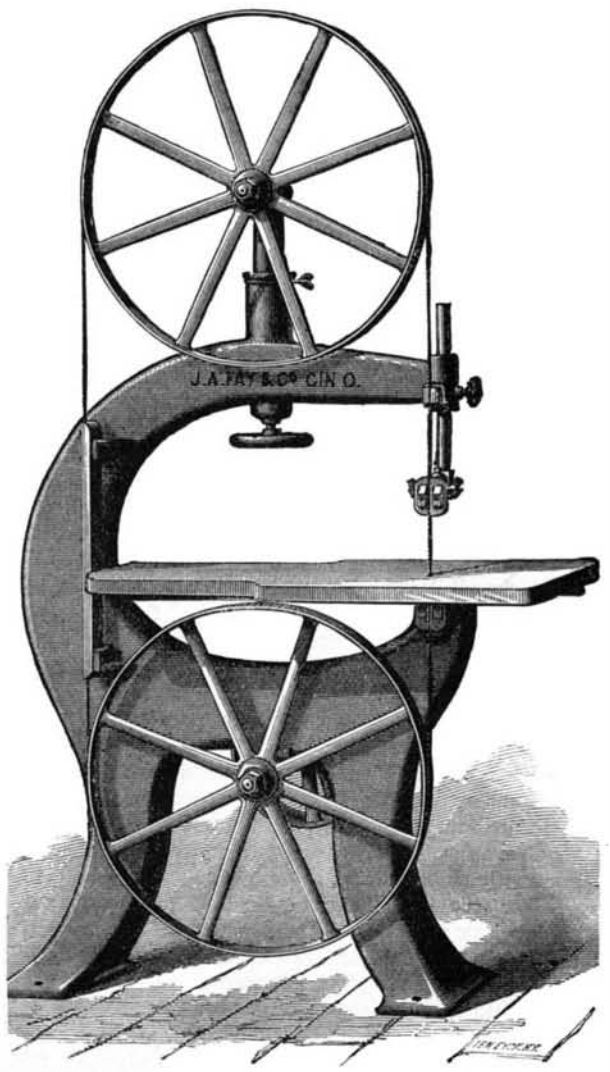


Fig. 2.—HARRISON'S NEW STANDARD GRINDING MILLS.

NEW IMPROVED BAND-SAWING MACHINE.

Band-sawing machines are in such universal use that the demand for them induces manufacturers to make changes to meet some newly developed want which may be discovered, and obtain prominence amongst operators of band saws. The varying changes in the form of machines, methods of producing flexibility in the motion of the upper saw wheel sufficient to prevent breakage of saws by any sudden variation in the tension of the saw, or leaving off some device used for a special purpose and not desired generally, thereby lessening the cost of construction, are, we think, worthy of notice.



We illustrate herewith a new band-sawing machine, the object of which is to meet the requirements of the demand for a machine of small cost with the adaptability to general classes of work.

The column of the machine is cast in one solid piece, forming a support to the wheels and table, of such proportions as to resist all inclination to vibration or flexure. The bearings of the wheels are long and arranged to avoid the wear incident to the revolution of their shafts.

The upper wheel bearing is supported upon a turned center, movable vertically in the column to compensate for differences in the lengths of the saws from breakage or other causes. It is raised and lowered by a screw and hand wheel. The upper wheel has a device attached to its support to direct the saw in its line of travel on the wheels, by a revolution of the upper wheel on a horizontal plane through the center of the axis of the wheel, thus placing the upper wheel at an angle to the lower wheel to give the saw sufficient lead to retain a constant pressure of its back against the guide rollers. The wheels are covered with an elastic covering to protect the teeth of the saw from abrasion, and to assist in compensating for variations in the tension of the saw blade.

The saw guides upon this machine are of the same pattern as those placed upon all band-sawing machines built by this house. They consist of a hardened steel roller which revolves as the back of the saw passes over it, relieving the saw from the friction caused by the back thrust, thereby obviating the most prominent cause of the fracture of band-saw blades. The saw is held in position by adjustable side guides, which can be regulated to accommodate different thicknesses and widths of blades. The upper guide is attached to a vertical bar which is adjustable to the thickness of the work sawing; the lower guide is attached to the column. Patented August 14th, 1877. For further information, address J. A. Fay & Co., Cincinnati, O.

THE flame of a mixture of two volumes of coal gas with three of carbonic acid gave a maximum heat of 1,000°. One volume of coal gas with two of carbonic acid gave 860°, while the maximum temperature reached with the flame of one volume of coal gas and three of carbon ic acid was 780°. Mixtures of coal gas and atmospheric air decrease in heat if the proportion of the latter exceeds what is necessary for combustion.—*F. Rossetti.*

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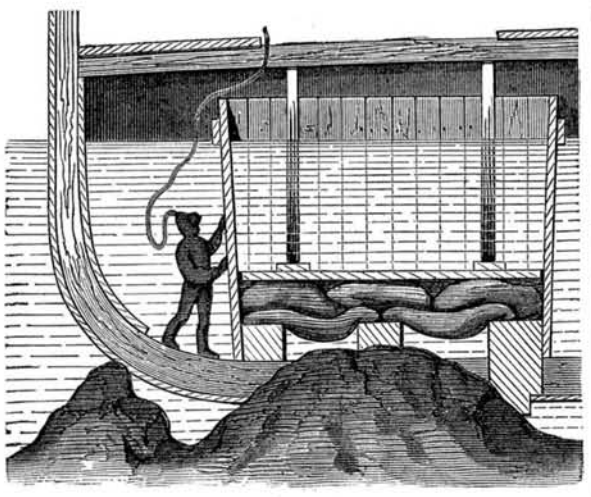
THE STEAMSHIP "MASSACHUSETTS" ON AND OFF THE ROCKS.

The Massachusetts, a new steamer plying on Long Island Sound between New York and Providence, recently ran upon a rocky beach, and was rescued from her perilous position by the exercise of good judgment and considerable engineering skill. The casualty referred to occurred near Rocky Point, L. I., at midnight on October 5th, when, owing to a strong current in shore during a heavy rain storm, the Massachusetts drifted broadside on the beach, which was strewn with large boulders, and became fixed in a position parallel with her course, her starboard side being towards the shore. The passengers were at once landed without accident. Captain Jones of the steamer and Captain Babcock, the President of the Providence and Stonington Steamship Company, Mr. Henry Steers, the shipbuilder, and Captain Merritt with his crew, of the Coast Wrecking Company, removed the cargo, and by the aid of divers located the leaks. The most serious injury was on the bottom, 48 feet from the stern post, a little towards the starboard side, where the planking, main keelson, and frames were injured and a hole averaging four feet in diameter was made. The stern was also damaged. Two or three leaks were stopped with mattresses and blankets, but the larger aperture required other expedients in order to expel the water and close the opening. Fig. 1 shows the position and nature of this opening, and also of the scratches and indentations on the planking.

Mattresses were forced into the hole, and a wooden cofferdam was built around it in the following manner: By means of adjustable templates, divers took the angles of the hull and keelsons, and the ends of boards 1½ inch thick were shaped to correspond with the angles obtained. It was then comparatively easy work to build the coffer dam, which is represented at Fig. 2.

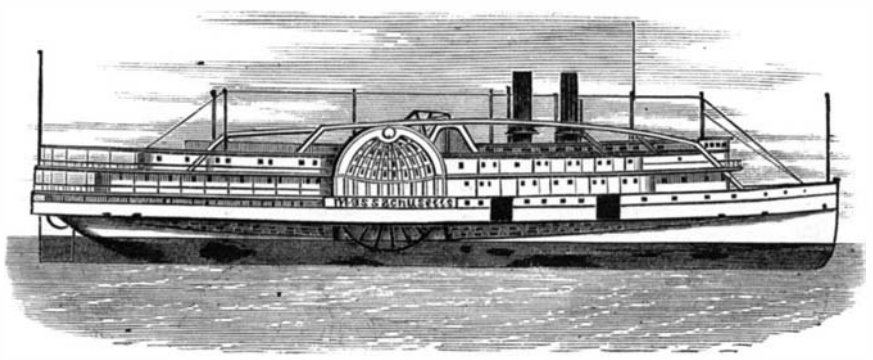
As the ends of the different boards were properly shaped they were placed in position and secured to the keelsons, until the cofferdam assumed much the shape represented. At the top it was of a trapezoi dal figure; 11 feet high, 8 feet wide aft, and 10 feet forward. A flooring was then put in at the bottom of this cofferdam over the inserted mattresses, and held down by shores. The coffer dam consisted of boards 1½ inch thick, covered with canvas and another course of boards placed outside, so as to break joints, the whole held together by upper and lower framework. This completed, and the smaller leaks stopped, a gang of men started the wrecking pumps. Holes were made on the main deck opposite the passenger gangway and cargo hatchways, and the suction pipes inserted. There were nine steam pumps in all; five pumps placed forward and four aft. The ship was relieved in three hours and floated at high water.

Two pontoons, about 15 feet long and 10 feet wide, were placed on the port side abaft the paddlewheel and under the guard, in order to straighten her up and ease the list. Two steamers then hauled her off. While the ship was being cleared of water, steam was got up in two boilers, which enabled the Massachusetts to leave her rocky bed and to proceed to the New York floating dry dock under her own steam, where, at the time of writing, she is, and where the damage done has been fully ascertained and examined, and the necessary repairs are being made. The illustration represents the Massachusetts in this dry dock, and ship-carpenters repairing the extensive break already described. As a matter of course the copper has all been removed from her bottom, and she is receiving a thorough overhauling. The scratched and indented planking has been cut out, new planking and extra pinning put in, new frames of the strongest description have been added, and she will be recaulked and recoppered from stem to stern.



THE COFFER DAM.—Fig. 2.

The injuries to the ship are not so serious as was at first supposed and stated. With the exception of the rent at the stern, the damage was confined to the planking and the rubbing away of some of the forward frames. These will be thoroughly renovated. Four of the six boilers were shifted from their settings, and the main copper steam pipe was cracked for a length of 24 inches on both sides, but the engine itself is in excellent condition. The repairs to the hull will probably not exceed $30,000. The Massachusetts is undoubtedly a very strong and substantial vessel, otherwise her position on the beach, where she rested and chafed for two weeks, would have strained if not broken her.



THE STEAMER MASSACHUSETTS.—Fig. 3.

The dimensions of the vessel are as follows: Length, water line, 325 feet; beam, 46 feet; beam, over all, 76 feet; depth of hold, 16 feet 4 inches.

Progress of the East River Bridge.

Twenty strands of the main cables are now finished and in position. Work on the approaches is going forward rapidly. On the Brooklyn side the second pier has been completed, and in a few days the men will have finished pier No. 4. On the New York side, one block of buildings on Pearl street between Cliff street and the Harper building, has been demolished, while the interior of the buildings on the opposite side have met with the same fate. As the outer walls of these buildings will not be in the way for some time, they have been left standing.

The Danger of Old Tobacco Pipes.

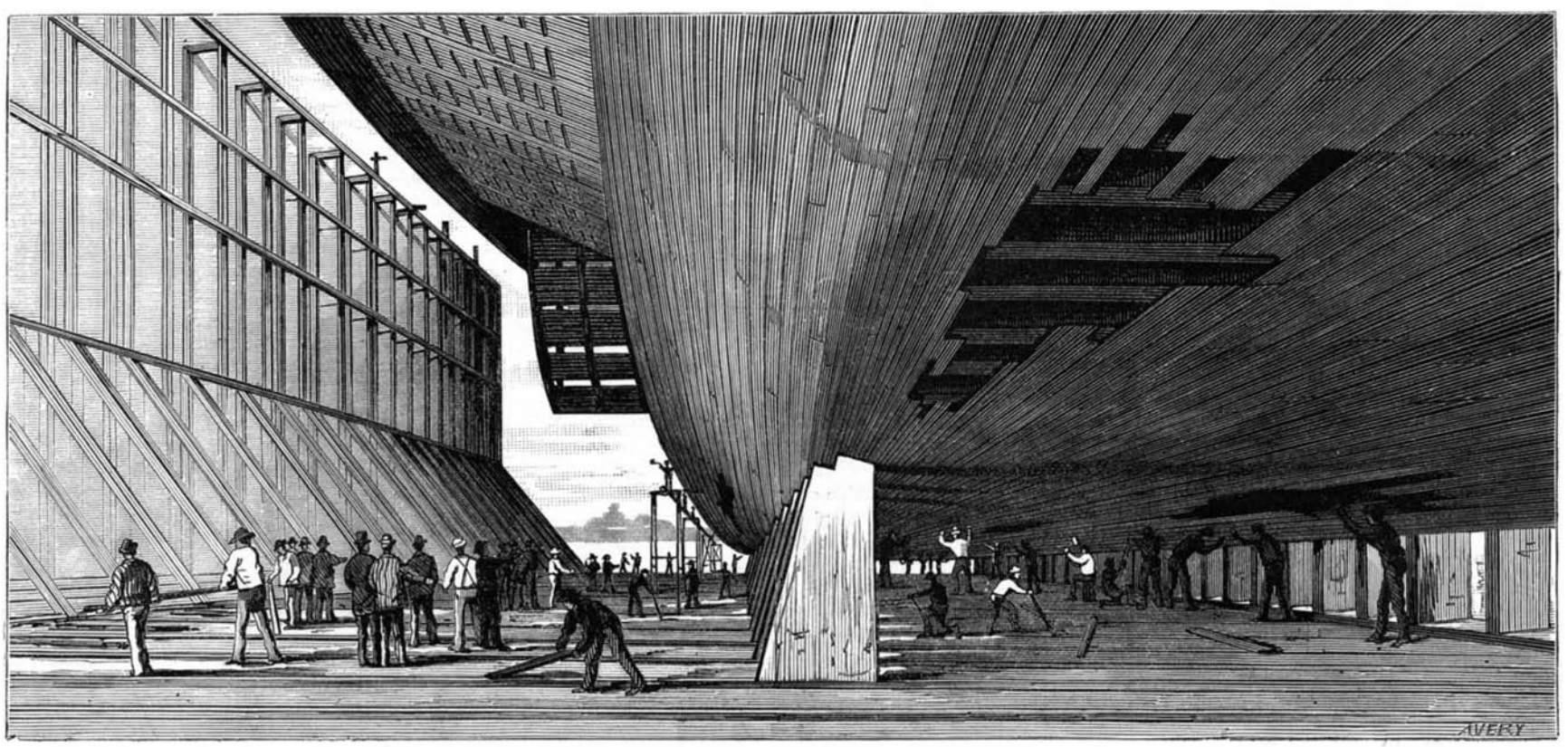
A case of so-called "nicotine" poisoning has recently happened in England which is attracting considerable attention. A child of about seven years of age amused himself by blowing soap bubbles in an old wooden pipe which had become foul by long usage. Shortly after, vomiting and convulsions ensued and the child died. The circumstance was put down as a case of "nicotine poisoning," but the *Chemist and Druggist* very cogently points out the impossibility of such being true, inasmuch as nicotine only exists in the unburnt leaf or juice, and the heat of combustion splits it up into other compounds. The cause of the death is therefore rather to be sought for in these compounds.

At the last meeting of the British Medical Association Professor McKendrick of Glasgow read a paper "on the physiological action of the Chrysoline and Pyridine Series of Compounds," detailing very extended researches and especially stating that these alkaloids seem to destroy life either by exhaustive convulsions, or by gradual paralysis of the respiratory nerves, thus causing asphyxia. According to the researches of Vohl and Eulenberg, alkaloids of the pyridine series are all then mobile and colorless liquids with a peculiar odor, and the same authorities consider that the stupefying effects of opium when smoked in a pipe are due not so much to the opium alkaloids "as to certain members of the pyridine series which are formed during its combustion." The physiological effects noted by Vohl and Eulenberg are contraction of the pupil, difficulty of breathing, general convulsions and congestion of the lungs, death taking place from asphyxia. These effects accord with those noted by McKendrick and likewise those observed in the case of the child previously referred to. Hence it is probable that death resulted from poisoning, not by nicotine but by the pyridine, picoline, etc., produced by dry distillation and existing in the old pipe.

Rank pipes it appears therefore are almost as dangerous as loaded pistols to leave about a house where there are young children. At the same time, they seem to offer not only the most disagreeable but the most deleterious method of smoking, as the user is sure to swallow some proportion of the poisonous alkaloids with which they are charged, and consequently to risk serious injury to the health, especially of those who have not become habituated to them.

Effects of Poison on Animals.

A French doctor has recently called attention to the fact that hemlock seed is eaten by mice without apparently producing fatal effects on them. He has recently succeeded in supporting two mice for eight days on hemlock seed. They ate it at first with repugnance, and even appeared to suffer from this diet. At the end of the eight days one of the mice seemed very ill, and next day he found the sick mouse half eaten by the other. The animals had eaten hemlock seed in quantities which would have been fatal to a man.



THE MASSACHUSETTS IN THE DRY DOCK.—Fig. 1.

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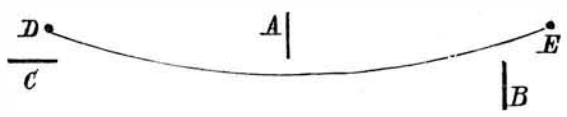
BASE BALL SCIENCE.

We are in receipt of several communications relative to the question of whether a projectile can be thrown so as to describe a horizontal curve during flight. Some of our correspondents favor us with newspaper clippings wherein we are quoted as deciding this problem in the negative. As the only reference to the matter which has appeared in these columns consists in letters from correspondents wherein the writers set forth *their* individual views—and our reply to a question which gave insufficient data, to the effect that we had never witnessed the conditions specified—it is scarcely necessary to add that we have never expressed the formal opinion imputed to us, especially as the views we do hold are diametrically the reverse.

Several learned professors in various Ohio educational institutions having recently embarked in a newspaper controversy as to whether a skillful base ball pitcher could or could not throw a ball in a horizontal curve—the question

Fig. 1.



was set at rest by actual experiment. A chalk line was drawn parallel to the plane of the home plate and first base, Fig. 1. Two sections, A B, of picket fence were placed on opposite sides of the line with their posts upon it. A flat board was placed at C, so that the edge of the board and the inner fence posts were in the same line. The ball was delivered from D with a right hand twist. It passed to the right of A and left of B, and struck the ground at E. When the pitcher stood on the opposite side of C, and threw with his left hand (the position of the barriers being relatively changed), the ball described a curve in the opposite direction.

The mode in which a ball is "pitched," in base ball playing, is shown in Figs. 2 and 3. Fig. 2 is the right hand of the pitcher drawn back. Fig. 3 the same purposely thrown forward more than usual to show the hand—the wrist being turned as the arm is swung, and the ball thus given a rotation from right to left. When thus projected the velocity of translation decreases more rapidly than the rotative velocity, which remains nearly constant. This is true of rifle cannon balls, the rotative velocity of which, at the end of their few seconds' flight, is found to be little impaired, although it is not nearly so rapid, the relative velocities of translation being considered, as is that of a base ball. The curve described by the ball, when thrown without twist, is of course in a vertical plane, and in its path it encounters resistance from the air, first, to its forward progression; and, second, to its upward movement during the first part of its flight; while, during the second part of its journey, and while falling the second resistance of the air is of course opposite to the attraction of gravity. In either case the resultants of these combined resistances act upon the forward portion of either hemisphere, A B, B C, of the projectile approaching A or C, Fig. 4, as the direction of motion more nearly approaches the vertical; or moving toward B as the path of the projectile, traveling in the general direction indicated by the arrow more nearly flattens. It will be evident, however, that over the entire trajectory there will be a vertical component of air resistance, opposing in one case the rising, in the other the falling, of the ball.

Fig. 2.

Fig. 3.

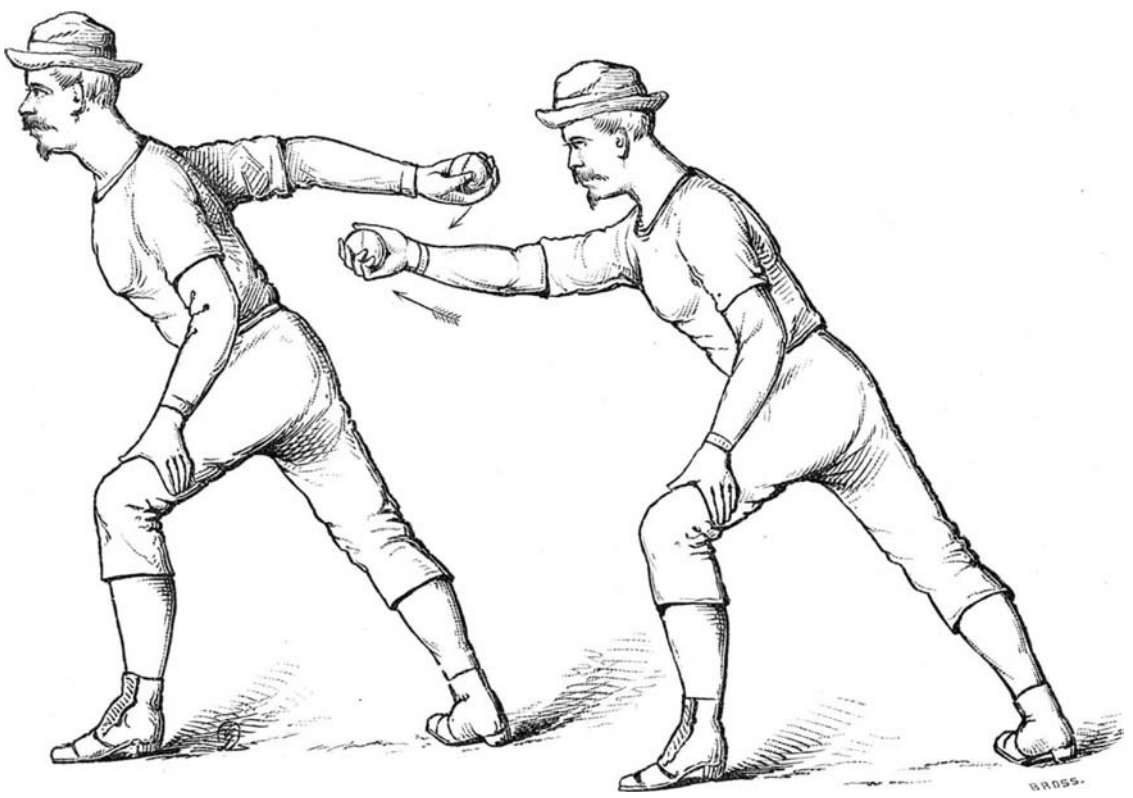
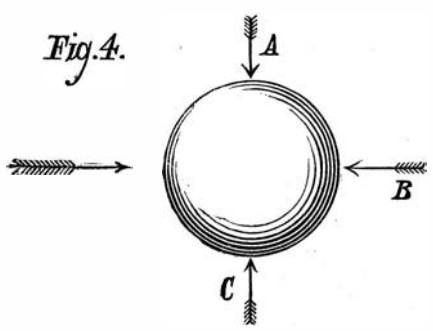


Fig. 4.



Now suppose the ball to be thrown with a twist, as indicated by the arrow in Fig. 5. During the first part of its journey the ball is rising, or moving in direction A B. But the resistance encountered by the side, A′, is equal to the sum of the resistances due to translation and that due to the rotation of the ball, while that on the side, A″, is due to their difference. Hence the ball will be thrown to the right or in the direction A C, and its path, after being impelled in the directions AB, AC, will clearly be somewhere between

Fig. 5.

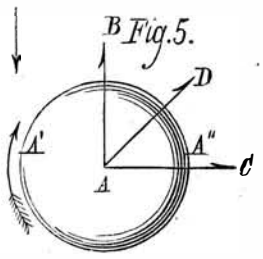
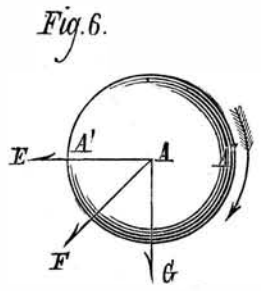
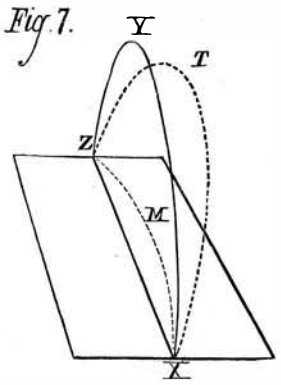


Fig. 6.



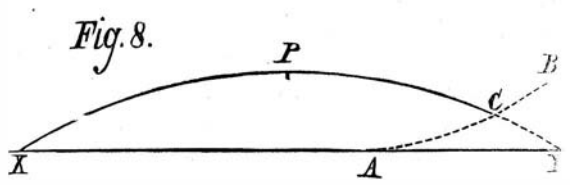
the two, or, for instance, on AD. (In the diagrams the ball is supposed to be traveling from the reader). This continues so long as the ball rises, but as soon as it begins to fall, Fig. 6, then, the resistance of the air being, from down, up along the vertical A G, the side, A″, of the ball meets the greatest opposition, and hence the projectile is thrown in the direction A E, and hence takes some intermediate path, as A F; consequently the ball during the first part of its flight drifts to the right, and during the second part to the left. The curve described, instead of being in a vertical plane, as X Y Z, in Fig. 7, is in an inclined plane, as X T Z, the projection of which is on a horizontal plane, becomes a curved line, X M Z.

Fig. 7.



It may be added that Commander A. P. Cooke, U.S.N., in his "Ordnance and Naval Gunnery," states that in rifle

Fig. 8.

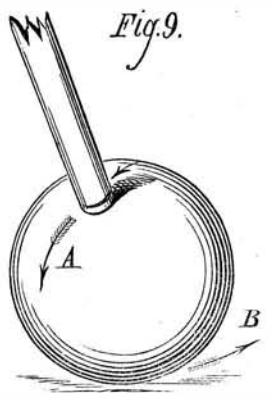


firing it is well known that projectiles "deviate in a curved line either to the right or left, the curve rapidly increasing toward the end of the range. This probably occurs from the velocity of rotation decreasing but slightly compared with the velocity of translation, and the trajectory is therefore a curve of double curvature, its projection on either a horizontal or vertical plane being a curved line."

A simple experiment in proof of the correctness of the above theory may be made as follows: Let a skillful pitcher, accustomed to allow for the twist he gives the ball when throwing it to a given distance, X Y, on level ground, throw with the same allowance to a point, C, at about the same distance off on a hillside, A B, Fig. 8. Now P being the highest point on the trajectory, the ball, for the reason already given, will deviate to the right from X to P. It would then deviate to the left in traveling from P to Y, on level ground, to compensate for this; but in traversing the distance, P C, less than P Y, there will not be sufficient compensation, and hence the estimate of the pitcher should be found untrue, the ball falling, instead of at the point, C, at some point to the right thereof. The converse result is is obtained by pitching down hill.

A good instance of a body being propelled in a curved line is afforded by the well known "perpendicular force shot" in billiards, whereby a ball can be made to travel around a hat or other object placed in the center of the table. This is illustrated in the annexed diagrams, Figs. 9 and 10. The ball is struck, as shown in Fig. 9, with the cue elevated at an angle of at least 45°. To cause it to curve to the right it is struck on the left with a quick impulsive thrust. It thus receives a backward or rather angular twist in the direction of the arrows, and at the same time is given a forward motion or translation toward the right and ahead, as indicated by arrow, B. The composition of these two motions, and the friction of the ball against the table, determine its movement in the curves shown in Fig. 10. The movement of translation to the right is at first the stronger, but eventually the rotating movement, tending leftward, prevails, and the ball at the end of its course inclines towards the latter direction.

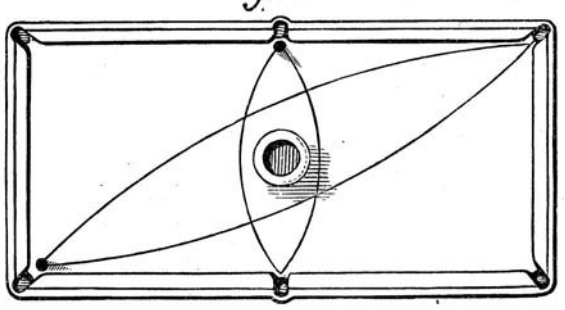
Fig. 9.



American Products in English Colonies.

We have frequently called the attention of our readers to the magnificent market for products of American invention and industry which is open in Australia. Progress on that continent only finds its parallel in our own past history, and its movement was never so rapid as now. How our manufacturers and inventors are taking advantage of the opportunity offered is shown by the following from the *British Mercantile Gazette*. Beef, cotton cloth, and hardware have hitherto been chief among the productions wherewith England has uniformly distanced competition; but what with importation of American beef, the sale of American cottons in Manchester itself, and now our large exports of hardware and machinery to English colonies, it would seem that the condition of affairs, so far as our English rivals are concerned, is very truly, as the *Gazette* states, one of serious importance. "We allude," says our contemporary, "to the ever lengthening list of American-made goods which not only in foreign markets, but in our own colonies, and even in this country, are gradually displacing and superseding English manufactures of the same description. In Australia and New Zealand, which are now almost the only shipping markets that exhibit any real vitality, the successful growth of this competition is especially alarming. Every month, we are told, on the authority of some of the oldest and largest firms in the trade, adds to the list of American and diminishes the list of English made goods. Sydney, it is stated, swarms with the representatives of American hardware houses, who spare no exertions to wrest the orders from English firms, and in too many cases with success, and the

Fig. 10.



reports from Sydney are echoed from Melbourne, and from the principal towns of New Zealand, Canada, the Cape, and many of the leading States of South America. In Australia and New Zealand the United States houses, we are assured, are carrying all before them, and at the present rate of progress it will evidently not be many years before these

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splendid and expanding markets are entirely lost to the manufacturers and merchants of the old country.

"The competition is not confined, as formerly, to those articles for the production of which the Americans enjoy natural advantages, such as wood work, but extend to leather goods, tinware, machinery, every description of implement and edge tool, carriage axles, force pumps, spades, shovels, axes, forks, files, locks, scales, tacks, rivets, pulleys, sewing machines, stove grates, guns, pistols, and other products too numerous to mention. In all these branches of manufacture the Americans are rapidly increasing their Australian business, whilst the English makers are losing ground. Australian commerce, as a whole, is certainly expanding, yet the returns of many well known English firms who supply the markets of Sydney and Melbourne are not now one tenth of what they were a few years ago. If we ask for an explanation of this extraordinary falling off, from those who are in a position to answer us, we are told that it is due to the successful competition of the Americans, who beat our manufacturers sometimes in price, always in quality, and not unfrequently in both. English manufacturers are slow to adopt new patterns or to accommodate themselves to the wants of their customers, but their American competitors spare themselves no pains or expense in this way. They are constantly on the look-out for novelty and improvement, and by good trade organization and close intercommunication they are always kept well posted up in what is being done by their rivals in other parts of the world. Their illustrated pattern books, which are distributed with lavish hand among their customers, are marvels of engraving and typography, and no amount of canvassing or advertising is spared to bring the merits of their productions before the world. Above all, the Americans take care that their goods shall correspond to sample, and be turned out in a finished and workmanlike manner, unlike those of many English makers, who never trouble themselves to inspect the work they send away."

Are Ants Civilized?

The October number of the *Quarterly Journal of Science* contains an article on "Our Six-footed Rivals," the ants, which may well cause us to believe that we are not the only rational and civilized beings on this globe.

Let us suppose that we were suddenly informed, on good authority, that there existed a race of beings who lived in domed habitations, aggregated together so as to form vast and populous cities, that they exercised jurisdiction over the adjoining territory, laid out regular roads, executed tunnels underneath the beds of river, stationed guards at the entrance of their towns, carefully removed any offensive matter, maintained a rural police, organized extensive hunting expeditions, at times even waged war upon neighboring communities, took prisoners and reduced them to a state of slavery; that they not merely stored up provisions with due care, but that they kept cattle and even cultivated the soil and gathered in the harvest. We should unquestionably regard these creatures as human beings who had made no small progress in civilization, and should ascribe their actions to reason.

Among the *hymenoptera* the lead is undoubtedly taken by the ants, which, like man, have a brain much more highly developed than that of the neighboring inferior groups. Perhaps the most elevated of the formicide family is the agricultural ant of western Texas. This species is, save man, the only creature which does not depend for its sustenance on the products of the chase or the spontaneous fruits of the earth. A colony of these ants will clear a tract of ground, some four feet in width, around their city, and remove all plants, stone, and rubbish. A species of minute grain, resembling rice, is sown therein and the field is carefully tended, kept free from weeds, and guarded against marauding insects. When mature, the crop is reaped and the seeds dried and carried into the nest. If this is done near a larger city the latter regard it as an intrusion, and a fierce warfare results, which ends in the total destruction of one or the other side. The queens are treated with great attention and installed in royal apartments.

The ant government is communistic. In a formicary there is no trace of private property; the territory, the buildings, the stores, the booty, exist equally for the benefit of all. The family among them scarcely exists. Rarely is the union of the male and female extended beyond the actual intercourse, all provision for the future young devolving upon the latter alone, the former being speedily killed, as he is no longer of any use. The females are the larger, stronger, and more long lived. The workers and fighters are sexless; to them belongs the real government of the ant-hill, and they provide for its enlargement, well being, and defence.

Ants are sometimes very stupid in regard to small things, but in many instances they display remarkable sagacity. Mr. Belt, in his "Naturalist in Nicaragua," tells of a column of ants who were crossing a watercourse by a small branch not thicker than a goose quill. They widened this natural bridge to three times its width by a number of ants clinging to it and to each other on each side, over which the column passed four deep, thus effecting a great saving of time. Again, the *eciton legionis*, when attacking the hill of another species, digs mines and passes the pellets of earth from ant to ant until placed at a sufficient distance outside to prevent it rolling back into the hole. Their errors and stupidity are not more conspicuous, however, than among the human beings.

These tiny creatures have a language by which they can impart to each other information of a very definite character, and not merely general signals, such as those of alarm. It has been found that ants fetched by a messenger seem, when they arrive at the spot, to have some knowledge of the task which is awaiting them. Their principal organs of speech are doubtless the antennæ; with these, when seeking to communicate intelligence, they touch each other in a variety of ways. There is a possibility that they may have a language of odors, for the various scents given off by them are easily perceptible. Under the influence of anger it becomes very intense. In battles how, save by scent, can they distinguish friend from foe? After a lapse of several months a former companion will be received kindly into the nest, but a stranger is killed.

More wonderful than their intelligence is their organization. If separate they would be helpless, and probably soon become extinct. Mr. Belt observed a marching column of *ecitons* in the primeval forests of Nicaragua. A dense body of ants, four yards wide, moved rapidly in one direction, examining every cranny and fallen leaf. At intervals larger and lighter colored individuals would often stop and run a little backward, apparently giving orders. On the flanks and in advance of the main body, smaller columns would push out, which pursued the cockroaches, grasshoppers, and spiders in the neighborhood. A grasshopper seeking to escape would often leap into the midst of the ants. After a few ineffectual jumps, with ants clinging to its body, it would soon be torn to pieces. Spiders and bugs which climbed to the tops of trees were followe dand shared a like fate. In Nicaragua the vegetarian ants eat up trees and carry off the leaves, to use as a manure, in which grows a minute species of fungus, on which they feed. They evince a mutual sympathy and helpfulness, which to an equal extent can be traced in man alone. Mr. Belt placed a little stone on one to secure it. The next ant that approached ran back in an agitated manner and communicated the intelligence to others. They rushed to the rescue: some bit at the stone, and tried to move it, others seized the prisoners by the legs and pulled. They persevered until they got the captive free.

In Australia they have been known to bury their dead with some degree of formality. The Texan ant removes any offensive matter placed near its city and carries it away. Ants who refuse to work are put to death. Prisoners are brought in by a fellow citizen, handed over in a very rough manner to the guards, who carry off the offenders into the underground passages.

The slave-making propensity and the reliance upon slaves occur in several species, but not to the same degree. The *polyergus rufescens* is absolutely dependent on its slaves, and would rather die than work. *Formica sanguinea*, on the other hand, has much fewer slaves, being itself capable of working as well as fighting. No less variation may be traced in the habits of the cattle-keeping ants. Of the honey-secreting *aphides* and *cocci* that serve them as milch kine, some have large herds, whilst others have none at all, and if they encounter an *aphis* straightway kill and eat it. These *aphides* are extremely destructive to fruits and trees, as they live by sucking the sap. The ants watch them with wonderful care, and defend them from all enemies.

Instances of sagacity and design might be easily multiplied. Careful observation has shown that the ants are evoluting as fast as their short terms of life will permit them. They are becoming more wise and more civilized yearly. Each century marks an advance. Who knows but that perhaps in the dim future they may assert rights which human beings shall be bound to respect?

Mushroom Ketchup.

Place agarics of as large a size as you can procure (not worm eaten), layer by layer in a deep pan, sprinkling each layer as it is put in with a little salt; the next day stir them up several times so as to mash and extract their juice. On the third day strain off the liquor, measure, and boil for ten minutes, and then to every pint bottle of the liquor add ½ oz. of black pepper, ¼ oz. of bruised ginger root, a blade of mace, a clove or two, and a teaspoonful of mustard seed; boil again for half an hour, put in two or three bay leaves, and set aside until quite cold; pass through a strainer and bottle, cork well, and dip the ends in resin. A very little Chili vinegar is an improvement, and some add a glass of port wine or a glass of strong ale to every bottle. Care should be taken that the spice is not added so abundantly as to overpower the true flavor of the mushrooms.

Asparagus Paper.

According to the *British Mercantile Gazette*, an excellent paper can be made out of the white ends of asparagus, which consist entirely of tough vegetable fibers. The material is adapted to the production of the finer kinds of writing paper.

NEW BOOKS AND PUBLICATIONS.

OUR COMMON INSECTS. By A. S. Packard, Jr. Illustrated. Estes & Lauriat, Publishers, 301 Washington street, Boston.

This is mainly a reprint of a series of popular papers on insects which appeared in the *American Naturalist*, from 1867 to 1871. Mr. Packard has devoted considerable attention to popularize entomological knowledge, and has already published several works similar to this. The descriptions of the various insects treated in the present volume are very full, notably free from technicalities and are abundantly illustrated. The chapter on the ancestry of insects wherein the strong genetic bond uniting the worms crustacea and insects is traced, and the various steps of the evolution of the articulate division of the insect kingdom pointed out, will be read with especial interest by all naturalists, while the insect calendar wherein the times of the appearance of injurious insects are noticed will be of much value to the farmer.

OUTLINES OF MODERN ORGANIC CHEMISTRY. By Professor C. Gilbert Wheeler, of the University of Chicago. A. S. Barnes & Co., New York city and Chicago.

A simple treatise on the science, partially based on Riches *Manuel de Chimie*, and especially adapted to the uses of colleges and schools, where extended study of the subject is not included in the course. It is in harmony with the most recent advances, and is concisely and clearly written.

THE SPORTSMAN'S NOTE BOOK. By Wakeman Holberton, 102 Nassau street, New York.

This a convenient little book bound in soft covers for use by sportsmen. It contains blank pages for a diary, blank scores for rifle matches, game scores, and valuable advice in regard to guns, fishing tackle, camp cookery, receipts for accidental wounds, and a condensed record of game laws and seasons in all the States.

THE TELEPHONE. An account of the Phenomena of Electricity, Magnetism, and Sound, as involved in its action; with directions for making a speaking telephone. Professor A. E. Dolbear, Tuft's College. Lee & Shepard, Boston. Illustrated.

Professor Dolbear has written this small book to meet the public want for a clear and concise explanation of the telephone. He makes plain the phenomena of electricity, magnetism and sound, and the numerous cuts inserted render the mechanical conditions intelligible. As the inventor of the magneto-electric speaking telephone, he describes at length his first instrument and gives directions to make an improved pattern. The book contains a great deal of useful information.

THE COUNTRY is the title of a new weekly journal devoted to the dog, the gun, yachting, fishing, etc., and published by "the Country" Publishing Association, No. 33 Murray street, this city. The first number before us has a capital table of contents. There are practical articles on training dogs, which abound in valuable suggestions: the correspondents columns are well filled with letters evidently prepared by men who know how to write as well as they understand handling gun and rod, and in a word the entire paper is bright, lively, and thoroughly interesting. Its aim is to deal with everything relating to the country, and with outdoor sports of all kinds. It is handsomely gotten up, and is well illustrated. We can bid the new comer a cordial welcome, and can commend it to our readers who are interested in outdoor sports. The subscription price is but 3 dollars a year.

Recent American and Foreign Patents.

Notice to Patentees.

Inventors who are desirous of disposing of their patents would find it greatly to their advantage to have them illustrated in the SCIENTIFIC AMERICAN. We are prepared to get up first-class WOOD ENGRAVINGS of inventions of merit, and publish them in the SCIENTIFIC AMERICAN on very reasonable terms.

We shall be pleased to make estimates as to cost of engravings on receipt of photographs, sketches, or copies of patents. After publication, the cuts become the property of the person ordering them, and will be found of value for circulars and for publication in other papers.

NEW MECHANICAL AND ENGINEERING INVENTIONS.

IMPROVED MACHINE FOR CROCHETING THE TOPS OF HOSIERY GOODS.

Joseph M. Merrow, Merrow Station, Conn.—This invention relates to a machine for crocheting or overstitching the top or edge of hosiery or knit goods, and it consists in certain improvements upon that type of machine in which a reciprocating needle carries the yarn or thread through the goods as advanced by a feed, while a hook forms a stitch by looping the thread above and below the work plate. The stitch, consisting of a loop from above the fabric and a loop from below the fabric, of two adjacent stitches having drawn through them a loop from the next stitch in order, is peculiar to this machine, and forms an elastic and ornamental finish for the edge of the work. This stitch is also adapted to joining or overseaming the edges of work, forming a strong seam, which is fully as elastic as the goods in which it is made.

IMPROVED PISTON PACKING.

J. H. Ferdinand Otto, Reedsville, Wis.—This invention relates to improvements in metallic piston packing, by which the packing rings are readily adjusted to the required degree of tightness by a simple mechanism. The inner and outer split packing rings of the piston are guided between the end plates and expanded by three or more interior band springs. These springs are operated upon by sliding nuts that are moved forward or back by means of radial screws, which are operated by a worm gear. The shafts of the intermeshing pinions pass parallel to the piston rod into inner sockets of the face plate, which is attached by screw bolts to the body of the piston. The sliding nut is guided between lugs on the inside faces of piston head and follower. The socket openings of the face plate are closed by short cap screws, which admit, when removed, the engaging of the key with the nicked ends of the pinion shaft, so as to turn the same and sets the springs and rings to the required degree of expansion.

IMPROVED TOOL POST FOR LATHES.

Robert Neasham, Mount Washington (Pittsburgh), Pa.—This relates to tool posts for engine lathes and similar tools, and it consists of a suppor for the tool which is made in two parts, the upper part being screwed into the lower part, and capable of being raised or lowered by turning the said lower part. The tool post passes through the support, and is mortised to receive the tool, which is clamped by a set screw in the usual way.

IMPROVED RAILWAY SWITCH SIGNAL.

George W. Anders, Woodsboro, Md.—The object of this invention is to provide an improved signal to indicate the position of the movable rails of a switch in the night time for the purpose of informing the engineer of an approaching train that the switch is open or closed, as the case may be. The invention consists in attaching to the switch lever a lantern having differently colored glass panes, and provided with a swinging lamp whose position in front of one or another of the colored panes indicates the position of the lever, and thereby the position of the switch rails also. The invention further consists in the particular construction of the lantern and swinging lamp.

IMPROVED COMBINED CRANK AND TREADLE POWER FOR DRIVING SAWS AND OTHER LIGHT MACHINERY.

Henry Shear, Arcola, Ill., assignor to himself and Edward Cornthwait, of same place.—The ends of the shaft, which revolves in bearings attached to the upper rear part of the frame, project at the sides of the frame, and to them are attached the cranks, which are made with an offset, forming a second crank. To the inner and shorter cranks are pivoted the ends of the connecting rods, the lower ends of which are pivoted to the ends of the treadles. The treadles are pivoted at their centers to pins attached to the lower part of the frame. To the driving shaft is attached a pulley, which is made large and heavy to adapt it to serve also as a flywheel, and around which is passed a band. The band also passes around a pulley attached to another shaft, which revolves in bearings attached to the upper part of the frame. In using the machine a man stands upon each treadle with a foot near each end, and grasps the crank with his hands. Then, by the natural motion of turning the crank his weight will be thrown alternately upon the opposite ends of the treadle.

IMPROVED SPARK ARRESTER.

John A. Blair and William C. Bush, Fair Hill, Md.—The object of this invention is to provide an improved spark and cinder catcher for locomotives and other engines which will catch the cinders and conduct them to

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the ground. The smokestack is slightly contracted at its upper end, and is surrounded by an annular concave receiver, which is fitted with a truncated sheet metal cone. Within this cone a similar cone is suspended by rods over the upper end of the smoke stack, with its lower edge projecting downward a short distance below and outside. At the sides of the smokestack there are pipes which are enlarged at their upper ends, and are connected with the receiver. The sparks and cinders that are projected upward by the exhaust of the engine are directed by the converging top of the smokestack against the inner cone, by which they are deflected so that they strike the inner surface of the outer cone, from which they drop into the receiver and are delivered to the pipes, by which they are carried downward below the boiler and permitted to escape to the ground.

IMPROVED SLIDE-VALVE ADJUSTER.

Henry B. Doolittle, Doolittle's Mills, Ind.—This invention relates to means for adjusting the strokes of the slide valves of reciprocating high pressure engines, and consists in an attachment for steam engines which is applicable to the arm of the rock shaft, and constructed with an adjustable slide having a wrist pin to connect with the rod of an eccentric on the main shaft. The object is to adapt a valve adjuster to engines as now constructed, so that the adjuster can be attached to the arm of the rock shaft without in any manner altering the engine.

NEW MISCELLANEOUS INVENTIONS.

IMPROVED LADDER.

Moses Foss, Cairo, Ill.—This ladder is made in two sections, and can be used as a step ladder. By a peculiar arrangement the two sections can be so constructed as to convert them into a long straight ladder. One section is so formed that the lower end is curved and notched, so that when the two sections are put together to form a long ladder, the upper section will be nearly in a plane parallel to the lower section, and the curved portion of the upper section will have a bearing against hooks, and will be firmly held by these hooks and the top round, which is received into the notches

IMPROVED STOVE.

Moses Jones, Hymer, Kan.—The firebox or inner shell is made of cast iron, and is provided with a top that extends to the outer shell. The outer shell is of sheet iron, and is higher than the firebox, and to it a cast iron top is secured. Between the top and the top of the firebox there is a flue, and below the top and around the sides of the firebox there is another flue. Slits are made in the back of the firebox, through which the products of combustion pass from the firebox to the flue. By opening the damper the smoke is permitted to escape directly to the chimney; and when it is closed the products of combustion pass through slits and a flue around the sides of the firebox to the front of the stove, where they pass upward through openings to the flue, and thence to the smokepipe. This arrangement not only utilizes the greatest possible amount of heat, but it also prevents the stovepipe from becoming dangerously heated.

IMPROVED TINNING APPARATUS.

John B. Jones, Brooklyn, N. Y.—In the operation of tinning five vessels or compartments are used. In this improved apparatus vessel the partition between two vessels is taken away, so that these become one vessel, and a shallow surface compartment is secured in the upper part of the vessel, the lower edge of which extends down a little into the melted tin, so as to confine the flux contained in it and prevent it from entering the other vessel and injuring the flux in said vessel. With this construction the goods are pushed along in the vessel without being raised out of the melted tin, and thus the necessity of dipping the flux back and forth is avoided.

IMPROVED GAME COUNTER.

Joseph H. Tahony, New Orleans, La.—This is an improved game counter more particularly designed for keeping count of the game in card playing, but applicable also for all other games which require a count. The object of the invention is to provide a neat and simple device for the purpose, to be used in the place of a pencil and slate, checks, or other commonly employed means of counting, and to this end the improvements consist, first, in arranging in a small box one or more disks bearing numbers on their peripheries and arranged on a shaft with a tension spring, so that as the disks are turned, from time to time, the numbers successively show through a slot in the top of the box, the disks being turned either by pressure upon their exposed surfaces or by specially provided means. The invention also consists in combining a set of these boxes with a partitioned tray adapted to receive said boxes, and also a pack of cards.

IMPROVED BUZZ TOY.

Stuart A. Standiford, Philadelphia, Pa., assignor to Mrs. M.L. Standiford, of same place.—This invention consists of a disk secured to a sleeve which is placed on a wire attached to a suitable handle. The wire is bent over the sleeve toward the disk, and in its outer end an eye is formed, through which a cord passes that is attached to the disk and wound around the sleeve. By pulling the cord the disk is made to rotate first in one direction and then in the other. It forms quite an attractive toy.

IMPROVED TOOL HANDLE.

John H. Anthony, Camanche, Iowa.—This invention furnishes improved fastenings for securing tools or hand pieces to handles. It is so constructed as to enable the said tools or hand pieces to be applied to new handles easily and quickly, so as to avoid loss of time and expense, while it holds the said tools and hand pieces firmly and securely. By screwing a screw ferrule inward upon the handle until the clamps are uncovered the tool and handle can be readily separated, so that the tool may be readily supplied with a new handle.

IMPROVED NAPKIN HOLDER.

Ephraim Mears, Terre Haute, Ind., assignor to himself and Samuel M. Young of same place.—This consists of a hook to which two arms are pivoted, which open horizontally, and are provided at their free ends with hooks for receiving the napkin. The object is to provide a napkin holder which will spread the napkin, so that it will more thoroughly protect the clothing.

IMPROVED SKATE HOLDER.

Ewen C. Henderson, Pictou, Nova Scotia, assignor to himself and Henry Fraser, of same place.—In using this device the toe of the skate runner is inserted between the lower parts of plates, and is then pushed upward between two springs. As the springs reach an opening in the runners their ends spring through it, so that the skates may hang upon the crossed upper parts of said springs. The skates are detached by pushing them upward and out at the upper end of the holder. When the skates are detached the holder may be readily carried in the pocket.

IMPROVED MACHINE FOR CHAMFERING AND CROZING STAVES.

Benjamin W. Sutherlen, Wykoff, Minn.—The object of this invention is to produce an improved simple, but effective, machine for chamfering, levelling, and crozing the ends of barrels or other casks. The invention relates to means for adjusting the chuck that holds the end of a barrel for the purpose of centering it with reference to the cutter head; for chamfering the barrel upon the sliding carriage, for forcing the barrel end into the annular chuck, and for chamfering, leveling, and crozing the barrel.

IMPROVED CENTERBOARD FOR VESSELS.

Stephen R. Babbidge, Rockland, Me.—This centerboard may be adjusted to equalize the center of resistance with the center of pressure from the sails, to prevent carrying a weather or lee helm. Horizontal grooves are formed in the sides of the well or trunk to receive the pin attached to the lower forward corner of the centerboard, to enable said centerboard to be adjusted horizontally. Vertical or inclined grooves are formed in the sides of the well, in connection with the horizontal grooves, and a pin is attached to the lower forward corner of the centerboard, to enable the said centerboard to be shipped and unshipped from the deck.

IMPROVED HEAD REST.

Isaac L. Peckham, Bangor, Me.—This is an adjustable head rest for passenger cars and steamboats, and consists of a rack plate attached to the wall or other support, and guiding a vertically adjustable plate that is secured by pawl and thumb nut, the said plate carrying a bracket with horizontally turning and clamped head rest. The whole device is made of suitable cast metal, to be manufactured at reasonable expense.

IMPROVED GALVANIC BATTERY.

Charles A. Hussey, New York city.—This invention is intended to produce a single-fluid battery of constant strength for running electromotors for light machinery, and all other purposes in which a constant current is required. The battery dispenses with the use of double-fluid batteries for these purposes, and consequently with the use of porous cups and other objectionable features of the same, while, it is claimed, providing a cheaper and more constant current than a two-fluid battery. The elements are made in the shape of disks or otherwise, and mounted upon the shaft and revolved therewith. As only a part of the plates at the time is immersed into the fluid, which part almost instantly emerges again from the same by the rotating motion imparted, and, as the hydrogen gas collected thereon is lighter than the atmospheric air, the surface covering of hydrogen is continually dissipated during the revolution of the plates in the air, and the plates kept free from polarization. Thus a current of constant strength is obtained, and a battery provided that may be used with equal efficacy at any moment.

IMPROVED OAR.

James W. Wall, Cleveland, O.—This consists in a combination of jointed and pivoted oar sections and base plate, having end slot and hole, with a cross catch pin and binding spring of a stationary strip of the gunwale, to admit oscillating motion of oar, and ready shipping and unshipping of the same. The noiselessness and ease by which the oar is worked, and the simple mode of shipping and unshipping the same from the strip of the gunwale, are special advantages.

IMPROVED TILE-LAYING MACHINE.

James H. Sparkes, Clinton, Ill.—This machine is so constructed as to open a channel to receive the tile and lay the tile in said channel as the machine is drawn forward. The mechanism is simple and ingenious.

IMPROVED SHOE FASTENER.

Victor Nivois, New York city.—This consists of a single wire bent into a zigzag spring, and having formed in it at intervals loops, which are bent backward or returned upon themselves. The lower end of the fastener is attached to the shoe by eyes, and placed between the lining and the upper, the loops projecting through the lining to receive a hook sewed to the upper of the shoe. This hook is formed from a doubled wire. The device forms a convenient and efficient fastening.

IMPROVED SHOWER BATH.

James R. R. Morford, La Harpe, Ill.—By giving vertical motion of a rod and its plunger water is drawn into a tube and forced therefrom through a rose. In the center of the rose or sprinkler is a staple, on which is applied an anti-friction sleeve, over which passes the strip that is used for raising and lowering a screen. Said screen may be made of any suitable waterproof fabric, and it has hoops secured to its ends and an opening through its side for the entrance and exit of a person. The lower end of the screen is held under hooks fixed to the tub, and the upper end has suspension cords attached to it, which are fastened to the strap. By these means the screen can be raised and lowered, and when raised it can be held tight.

IMPROVED FIRE ESCAPE.

Joseph Davenport, Massillon, O.—Upon a platform four T-shaped guides are secured, which are placed at right angles to each other, and upon each of which a slide is arranged. Four sets of bars are jointed together to form lazy-tongs, and are secured together at their outer joints by curved pieces. The bars of each series thus unite diminish in length toward the top of the series, so that all, when united, form a structure of pyramidal shape. Levers are pivoted in standards attached to the platform, and extend outward under the central joint of the lower bars and inward under a plate. Pulleys are journaled between ears projecting from the under surface of the plate. Ropes are attached to the slides and run over the pulleys and downward to a windlass under the platform, to which windlass they are attached. The windlass has upon it a spur wheel that is driven by a pinion on a shaft, which is journaled to the truck frame, and is provided with cranks. At the top a basket is suspended by cords. By turning the windlass the rope is drawn over the pulley and the slides are drawn toward the center of the platform, and at the same time the plate is drawn downward, carrying with it the inner ends of the levers, the outer ends raising and carrying with them the lower pairs of jointed bars, causing the four series of bars to move upward, carrying with them a basket.

NEW AGRICULTURAL INVENTIONS.

IMPROVED GANG PLOW.

Daniel M. Funk, Harrisburg, Oregon.—The object of this invention is to furnish an improved gang plow, which shall be so constructed that it may be adjusted to work at any desired depth in the ground, which may have the pitch of the plows changed as hard and soft places occur without having its adjustment changed, which will enable the plows to be readily raised from the ground for convenience in passing from place to place, which will allow each plow to rise independently of the others to pass obstructions, and which shall be simple in construction, readily controlled, and may turn a square corner without having the plows raised from the ground.

IMPROVED COTTON HARVESTER.

Ferdinand Van Dorn, Basking Ridge, N. J.—The object of this invention is to furnish a machine for removing the cotton from the ripe bolls, by means of a current of air produced by a revolving fan, without injuring the unripe bolls or the plants, and deliver the fiber clean and free from leaves and other impurities ready for ginning. The air and cotton enter a sack, the force of the blast being so weakened by the gauze of the spout and the gauze of the sack that the cotton sinks to the bottom of the sack while the current of air passes around the inner edge of a partition and out through the open part of the front opening of the sack. Any cotton that may be carried out by the air will settle down in front of the machine, and be again drawn through it. The cotton is removed from the sack when required through an opening between the rear edge of its bottom and the lower edge of its rear side.

IMPROVED ADJUSTABLE HARROW, GROUND MARKER, AND CORN CULTIVATOR.

George E. Cooke, Rossville, Kan.—The object of this invention is to furnish an improved machine, which shall be so constructed that it may be used as an ordinary harrow for preparing the soil, for marking the ground for planting, and for cultivating small plants, and which may be adjusted to any desired width, and may be readily raised from the ground to clear it of rubbish, and for passing from place to place. To the upright part of the bar, near its lower end, is attached a coupling, to which the double tree is attached, several holes being formed in the said upright part to receive the bolt that secures the coupling to it, so that the point of draft attachment may be adjusted higher or lower, as may be desired. Several holes are formed in the bar to receive the pin, so that the crosshead can be readily moved forward or back to adjust the harrow wider or narrower, as may be desired. By operating a lever the harrow may be raised and lowered and adjusted to work at any desired depth in the ground.

IMPROVED GATE.

Irvin Yost, Thornville, O.—This invention relates to an improvement in that class of farm gates which are pivoted in such a manner as to swing in a vertical plane, and thus avoid obstruction by snow and ice, and also admit of easy operation by means of levers extending either way from the gate, at right angles thereto. The invention particularly relates to the construction and arrangement of the devices for latching and unlatching the gate, and also counterbalancing and operating the same. (For details, see patent.)

IMPROVED ZIGZAG FENCE.

Nathan H. Hamlet, Wabash, Va.—This is a new zigzag or worm fence, which may be made stronger and cheaper than hitherto. The nature of the invention consists in notching together the top rails of the sections, and securing the rails to posts or battens arranged in the crotches formed by the lapping or crossing of the rails.

IMPROVED MEAL BIN.

John C. Durbin, Columbus Junction, Iowa.—The object of this invention is to furnish for kitchen use an improved flour chest for storing the flour, sifting the same, and providing receptacles for the different articles, the same having a hinged molding board and space for all the parts required for making bread, pastry, etc., in one convenient piece of furniture.

IMPROVED GATE.

Robert A. Horning, Karns City, Pa.—This consists of a folding gate made on the lazy-tongs principle, and swinging on a fixed lower and a turning upper pivot by means of double folding levers secured centrally to the front end of the gate. The rear ends of the double folding levers are connected by a slotted pivoted piece with an upright weighted rod, which is operated to open or close the gate by links, levers, and handles extending at both sides of the gate along the road. The double folding levers are jointed by connecting bands and pivots, and prevent the sagging of the gate when closed. The connecting crossrod of the double levers locks the gate automatically into recesses of the gate posts.

IMPROVED RING AND PULLEY FOR NECK YOKES.

Samuel M. Palmer, Glens Falls, N. Y., assignor to Walter McDonald, of same place.—This consists of a ring fitted with a pulley having flanges for retaining the strap that passes around it. A guard, consisting of two disks, is perforated to receive the ring and connected by a strap which is bent twice at right angles, forming, together with the face of the pulley, an aperture, through which the pulley strap passes around the pulley.

IMPROVED SEED PLANTER.

William S. Barton, Orangeburg, S. C.—This invention consists in the combination of the valve, provided with the double cam, the prongs of unequal length, the pivoted lever, and the open keeper with the wheel and with the rounds of the handle. The beams are made short and the rear ends are attached to the handles, between which is pivoted the dropping wheel. This wheel is made in the form of two cup-shaped disks, which are placed with their concaved sides toward each other, and are connected together by bolts passing through them near their edges. In the adjacent edges of the disks of the wheel are formed holes, which are closed upon the outer sides by valves rigidly attached to double cams, which are pivoted to the wheel. A lever is pivoted to a crossbar attached to the lower part of the handles, and to the lower end of which are attached two prongs. The prongs are made of different lengths, and are so arranged that an end of the longer one will strike the cam and open the valve just as it begins to rise from the ground. As the seed drops to the ground the shorter prong strikes the cam and closes the valve. The upper end of the lever passes through an open keeper attached to the upper crossbar of the handles, so that the lever can be turned to one side to move the prongs into such a position that they will not strike the cam, thus enabling the machine to be drawn from place to place without dropping seed.

IMPROVED WEED-FOLDING ATTACHMENT FOR PLOWS.

Thomas M. Harbert, Burlington, Kan.—This invention consists in a folder formed into bends, curves, and inclines, to adopt it to be attached to a plow beam for dividing, guiding, and folding down grass into the furrow. Upon the forward part of the plow beam a cast iron collar is secured, the lower part of which is formed into flanges for the folder to rest in. Upon the landside of the plow beam the fender is bent outward, and then downward to divide the grass, and extends back with a downward inclination nearly to the point of the plow, where it is bent obliquely toward the plowed land, so as to be nearly parallel with the moldboard, to cause it to bend down the grass upon the furrow slice.

NEW HOUSEHOLD INVENTIONS.

IMPROVED DUMB WAITER.

James Murtaugh, New York city.—This invention relates to that class of elevators known as "dumb waiters;" and the nature of the invention consists in so constructing a dumb waiter in a building that it can be conveniently used by different families residing in the several stories of the building and in adjacent apartments on the same "flat." Around the brake wheels are applied brake straps, the ends of which are connected to the angular ends of levers, having their fulcra on the horizontal beams of the uprights. A weight hangs free and acts on the levers to free the brake straps from their wheels. By pulling on one of the ropes the brake strap of the lever connected to such rope will be drawn tightly around its drum or wheel. At the same time a weight will be raised. When this weight is released the weight on the rope opposite to that which was pulled will cause its lever to operate the brake strap. Thus it will be seen that both brakes are brought into operation by drawing on either one of the ropes. By this arrangement a single elevator or dumb waiter will answer for a number of tenants living in separate apartments.

IMPROVED FOLDING CHAIR.

Charles H. Sutherland, Brownsburg, Va.—This invention relates to an improvement in the class of folding chairs whose back pieces and legs are detachably connected. The improvement relates to the use of hinged or pivoted arms, which are adapted to be detachably connected with the back pieces of the chair, and thus lock the several movable parts of the frame in the open or extended position. A foot board is pivoted to the rockers to adapt it to be folded back out of the way, or to be extended to support the feet of the occupant of the chair.

IMPROVED KITCHEN CABINET.

George P. Ziegler, York, Pa.—This article of furniture is designed to embody in compact form various kitchen utensils and storage compartments, such a sink bench, table, kneading trough and board, ironing board, meal and spice drawers, knife and rolling pin boxes, flour chest, etc. The novel feature consists in combining with the hinged cover a hinged leaf having strips upon one side to form a sink bench and a plain surface upon the other, which plain surface of leaf co-operates with a second leaf, hinegd to the opposite side of the cover, to form a table.

IMPROVED STAND FOR SMOOTHING FABRICS.

John F. Frese, Baltimore, Md.—This consists in an adjustable frame or smoothing board, which is pivoted to standards and constructed with a metallic surface, on which the moist and starched fabrics are smoothed and dried. It will be found, on removing them, that they are smoothed and glossed as though they were ironed.

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Business and Personal.

The Charge for Insertion under this head is One Dollar a line for each insertion.

For Sale.—Owing to poor health by the owner, a quarter interest is offered in The Frost Manufacturing Co., of Galesburg, Ill., a general foundry and machine business. Been in successful operation for 22 years. Address F. M. Co., Galesburg, Ill.

Polishing Supplies for all kinds of Metals. Greene, Tweed & Co., 18 Park Place, N. Y.

Best and Cheapest Wagon Tire Upsetter, only $12. Circular free. H. W. Seaman & Co., Millport, N. Y.

Electric Bells, Electric and Telegraphic Apparatus, Galvanic Batteries; every variety, very cheap. H.Thau, 85 Nassau St., New York city.

The Celebrated Farm Grist Mill; the grinding parts are steel. It is unsurpassed. Send stamp for descriptive circular. Wm. L. Boyer & Bro., Philadelphia, Pa.

Patentees and Inventors may obtain Capital to a limited amount, on fair terms, to introduce perfect or protect approved inventions, by addressing W.Foster, P.O. Box 3,074, New York city.

Metallic Letters and Figures to put on patterns of castings, all sizes. H.W.Knight, Seneca Falls, N.Y.

C. C. Phillips, 4,048 Girard Ave., West Phila., manufactures Vertical and other Burr Mills adapted to all kinds of grinding; also Portable Flouring Mills.

Planer, 5 x 2, for sale. C.R.Ellis, 182 Center St., N.Y.

Boulter's Superior Muffles, Assayers and Cupellers Portable Furnaces, Slides, Tile, Fire Brick and Fire Clay for sale. 1,609 North St., Philadelphia, Pa.

It is a sure sign of an old Overcoat when cut short. All Overcoats are cut long; and all short Overcoats are several years old. We have this information from the leader of the retail Clothingtrade in America.—Baldwin, of course.

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Wanted.—A 20 to 25 Horse Power Engine and Boiler, of the most approved kind, either new or second-hand. Edward Harrison, 135 Howard Ave., New Haven, Conn.

For Land with 500 feet water front, 35 minutes by boat from Wall St., accessible by rail, address P.O.Box 3,684, N. Y.

John T. Noye & Son, Buffalo, N.Y., are Manufacturers of Burr Mill Stones and Flour Mill Machinery of all kinds, and dealers in Dufour & Co.'s Bolting Cloth. Send for large illustrated catalogue.

Miners know our All Steel Pat. Bushings stand when others fail. Penfield Block Works, Lockport, N. Y.

A most Complete, Practicable, Durable, and Cheap Burglar Alarm has been invented and put on the market by Messrs. Hutchinson & Ransom, Cleveland, O. Costs only from $3 to $10 for a house. Send them 75 cents for sample and circular.

Wanted—A Steam Yacht, about 40 ft. keel and 8 ft. beam. Address, with particulars and lowest cash price, Woodbury Kramer, 102 State St., Rochester, N. Y.

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Solid Emery Vulcanite Wheels—The Solid Original Emery Wheel—other kinds imitations and inferior. Caution.—Our name is stamped in full on all our best Standard Belting, Packing, and Hose. Buy that only. The best is the cheapest. New York Belting and Packing Company, 37 and 38 Park Row, N. Y.

Steel Castings from one lb. to five thousand lbs. Invaluable for strength and durability. Circulars free. Pittsburgh Steel Casting Co., Pittsburgh, Pa.

For Best Presses, Dies, and Fruit Can Tools, Bliss & Williams, cor. of Plymouth and Jay Sts., Brooklyn, N.Y.

Hydraulic Presses and Jacks, new and second hand. Lathes and Machinery for Polishing and Buffing metals. E. Lyon & Co., 470 Grand St., N. Y.

40 Horse Second-hand Upright Engine wanted, in good order. J. Leffel & Co., Springfield, O.

Small Fine Gray Iron Castings a specialty. Soft and true to patterns. A. Winterburn, 16 De Witt street, Albany, N. Y.

Tin Foil.—J. J. Crooke, 163 Mulberry St., N. Y.

For the best Gate Valves of all kinds, apply to D. Kennedy & Co., 88 John St., N. Y.

Plumbers—Address Bailey, Farrell & Co., Pittsburgh, Pa., for the best and cheapest iron case street hydrants.

Magic Lanterns and Stereopticons of all prices. Views illustrating every subject for public exhibitions. Profitable business for a man with a small capital. Also lanterns for college and home amusement. 74 page catalogue free. McAllister Mf. Optician, 49 Nassau St., N.Y.

"Little All Right," the smallest and most perfect Revolver in the world. Radically new both in principle and operation. Send for circular. All Right Firearm's Co., Lawrence, Mass., U.S.A.

For Solid Wrought Iron Beams, etc., see advertisement. Address Union Iron Mills, Pittsburgh, Pa., for lithograph, etc.

Shaw's Noise-Quieting Nozzles for Escape Pipes of Locomotives, Steamboats, etc. Quiets all the noise of high pressure escaping steam without any detriment whatever. T. Shaw, 915 Ridge Ave., Philadelphia, Pa.

Bolt Forging Machines and Power Hammers a specialty. Send for circulars. S. C. Forsaith & Co., Manchester, N. H.

Felt of every description for Manufacturers' purposes, especially adapted for Polishing, can be furnished in any thickness, size, or shape. Tingue, House & Co., Manufacturers. Salesroom, 69 Duane St., N. Y. Factory at Glenville, Conn.

Gray & Wood Planer; Ball's Planer and Matcher; Smith's Mortiser; Universal Woodworker; Tenoning and Moulding Machines; in good order, and cheap for cash. Address D.W. W. Smith, 135 N. 3d St., Philadelphia, Pa.

Models made to order. H. B. Morris, Ithaca, N. Y.

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The Varnishes and Japans of Hyatt & Co., established 1872 ("The London Manuf. Co."), made from scientific formula by a practical maker of materials, free of deleterious substances, are, in the success met with, noted for color, purity, and durability, with cheapness, giving them meritorious pre-eminence. Try them. Send for circulars and price list to Company's office, 246 Grand street, N. Y.

Silver Solder and small Tubing. John Holland, Cincinnati, Manufacturer of Gold Pens and Pencil Cases.

Mill Stone Dressing Diamonds. Simple, effective, and durable. J. Dickinson, 64 Nassau St., N. Y.

Patent Scroll and Band Saws. Best and cheapest in use. Cordesman, Egan & Co., Cincinnati, O.

For Boult's Paneling, Moulding, and Dovetailing Machine, and other wood-working machinery, address B.C. Machinery Co., Battle Creek, Mich.

Chester Steel Castings Co. make castings for heavy gearing, and Hydraulic Cylinders where great strength is required. See their advertisement, page 318.

Wanted—Salesman thoroughly acquainted with Wood and Iron-working Machinery. Address John H. Kerrick, Indianapolis, Ind.

Notes & Queries

(1) J. H. P. asks how to get a good and durable dark blue on a gun barrel with acids, and without heat? A. Apply nitric acid and let it eat into the iron a little; then the latter will be covered with a thin film of oxide. Clean the barrel, oil, and burnish.

(2) W. H. L. S. asks: What is the mechanical effect used on the stage in making one scene disappear gradually, and another appear as gradually in its place? A. One way is to arrange a mirror in rear of the stage, the glass being placed at an angle to the footlights so that it will reflect a person standing near the side of the stage, but concealed from the view of the audience. The person stands in a dark compartment, so that his reflection in the glass is normally quite faint. A strong calcium light is then thrown directly on the person so that a vivid reflection appears in the glass. When the light is gradually diminished the reflection appears to fade, and when gradually strengthened on a second person, near the first, the former comes into prominence. Similar effects are produced by the magic lantern.

(3) R. H. W. asks how to soften a lump of gold that is too hard. It has a little copper and silver in it. A. Anneal by the ordinary methods. The presence of tin will sometimes harden alloys of gold and silver.

(4) N. G. P. ask: Will you please give me a recipe for putting a black polish on white wood? A. Mix up a strong stain of copperas and logwood, to which add powdered nutgall. Stain your wood with this solution, dry, rub down well, oil, then use French polish made tolerably dark with indigo or finely powdered stone blue.

Also give me a recipe for making a cheap but durable mucilage? A. Macerate 5 parts of good glue in 20 parts of water for 24 hours, adding 20 parts of rock candy and 3 parts of gum arabic.

Will cream turn yellow, when used as a secret writing fluid on postals, when exposed to heat? A. Yes.

(5) J. H. P. says: I have just tried an experiment on making vinegar from the wild crab apple. It has from two nights' and one day's standing got quite sour, but too bitter to use. How can I get the bitter taste from it without doing it an injury? A. Warm a sample of the vinegar and agitate it with a little egg albumen. If after settling 2 hours it is not improved, distillation must be resorted to.

(6) L. P. M. asks for (1) a lacquer to gild burnished iron and zinc? A. A good lacquer consists of alcohol, 8 ozs.; gamboge, 1 oz.; shellac, 3 ozs., annatto, 1 oz; solution of 3 ozs. of seed lac in 1 pint alcohol. When dissolved add ¼ oz. Venice turpentine and ¼ oz. dragon's blood to make it dark. Keep in warm place for 4 or 5 days. 2. Also the best method of removing stains from gold and silver plating? A. Immerse for some time in a solution of ½ oz. cyanide of potassium to 1 pint rain water, and brush off with prepared chalk.

(7) A. A. R. asks the length of time incubation takes for hen's eggs, turkey's, duck's and geese', and the degree of heat during the time from first to last? Also the management the eggs require? A. Geese 30 days, turkeys 27 to 28, ducks 28, hens 21. Temperature 140°. The eggs should be turned every 6 or 7 days, and the chicks, when hatched, kept until strong under an artificial mother made of sheepskin.

(8) R. A. McC. asks for a preparation that will erase lead pencil writing from printed pasteboard cards (colored) that will not injure the printing or color of cards? A. Stale bread or possibly soft "bottle" india rubber.

(9) C. M. C. asks: If the requisite length of a pendulum rod to vibrate seconds is $39\frac{3}{10}$ inch, how can the number of vibrations be found from any given length of rod, or *vice versa*, the length of rod from the number of vibrations? A. The time of oscillation increases in the same ratio as the square root of the length of the pendulum. Thus if the length of a pendulum be increased 4, 9,16, times, the time of its oscillation will be increased only 2, 3, 4, times.

(10) J. C, W. asks: 1. What was the cost of the Suez Canal? A. $80,893,665, or about $808,936 per mile. 2. What was the greatest engineering work of modern times, and what was its cost? A. The Mississippi jetties and the tunnel under the Straits of Dover, both unfinished.

(11) D. U. G. says: I have had several arguments with parties in our town about making rust joints in cast iron, and have been told that it cannot be done. I claim that it can be done; but how I cannot tell If you can give me any information upon the subject it will be thankfully received. A. Rust joints are made by mixing the following ingredients in the given quantities, and driving the mixture with a caulking tool into the joint: Cast iron turnings or borings, 100 lbs.; powdered sal ammoniac, 1 lb.; flowers of sulphur ½ lb. The latter ingredient is sometimes omitted.

(12) W. G. M. says: 1. The *Nautical Almanac* gives the polar distance of Polaris for January 1, 1870, as 1° 23′ 01″. The formula for computing the azimuth of Polaris for the same date and for latitude 42° gives azimuth of Polaris 1° 51′ 45″. Will you please explain why the azimuth is greater than the polar distance? A. Azimuth is the distance between the meridian of any place and a vertical circle starting from the zenith of that place, measured on the horizon—the vertical circle of course cutting the center of the star whose azimuth it is designed to measure. It follows that, as the pole must be in the exact meridian, and an object either east or west of the pole is on a vertical divergent from the meridian of the place, of course it will be further from the meridian at the horizon than at the polar altitude. It must be understood that twice every twenty-four hours the azimuth of Polaris is 0°; this, of course, is when it is upon the meridian, either above or below the true pole. 2. Also why the azimuth increase, and decrease, with the latitude, as the azimuth for the same date for latitude 30° is 1° 36′, but for latitude 50° is 2° 9′ 15″. A. As the zenith approaches the pole, the meridian and vertical circle, passing through an object of a given distance from the pole, will be more divergent, and of course make a wider space on the horizon, where the azimuth is computed.

(13) J. W. asks: What if the best system of artificial ice making? Is not chymogene dangerous to use? A. You will find that the special merits and demerits of the several systems mentioned have received ample comment in these columns. That system is of course the best by which the maximum quantity of good ice is produced at the minimum cost in money and labor. Liquefied gases—as sulphurous acid and ammonia—although incombustible, are not less dangerous than ether or chymogene. Other things being equal, the process supplying the more volatile reagent is usually the most effective.

(14) B. D. N. asks: What will remove coal oil from boards? A. Strong lye.

How can I make rubber cement? A. Fill a bottle $\frac{1}{5}$ full of native indiarubber cut in shreds. Pour in benzole until the bottle is ¾ full. Shake every few days until the mixture becomes as thick as honey. This dries quickly.

What causes the Indian summer? A. No definite theory.

Is gas escaping in a room where a lamp is burning liable to set a house on fire? A. Yes, if a sufficient quantity enters to produce an explosive mixture with the air.

Is there such a chemical as hypophosphite of potassa? A. Yes.

What is dextrin? A. A gum-like product of the action of dilute acid upon starch at 200° to 212°.

(15) J. W. W. asks how to make a black ink in a cold or lump form, so that by adding water I can make ink as wanted? A. A good ink powder, which might with a little mucilaginous material be made into blocks by pressure, consists of Aleppo galls, 3 lbs.; copperas, 1 lb.; gum arabic, ½ lb.; white sugar, ¼ lb.; powder and mix; 2 ozs. of this powder dissolved in 1 pint of boiling water gives a very good ink.

(16) J. R. asks: How can I make a fine quality of ink to stencil boxes, with stencil plates, and also not very expensive? Also the mode and preparation of making and drying it? A. Sulphate of manganese, 2 parts, lampblack, 1 part; sugar, 4 parts; all in fine powder and triturated to a paste with a little water.

(17) E. H. says: 1. If I sink a cylinder weighing 10 lbs. at a depth of 20 feet in water, what pressure on the square inch would I obtain on its piston, the latter being 3 inches in diameter? A. The pressure of the water on the piston, at the commencement of its stroke, would be about $8\frac{7}{10}$ lbs. per square inch, varying a little with the temperature of the water. 2. What weight would bring the cylinder up at the surface of the water after the piston has made its full stroke and bears against the bottom of the cylinder? A. The weight of the submerged cylinder would be 10 lbs. diminished by the weight of the volume of water which it displaces, which volume cannot be calculated from the data given.

(18) E. L. W. asks for a recipe to make the composition to put on matches? A. A good paste for matches contains: 1. Common phosphorus, 4 parts; niter, 16; red lead, 3; strong lead, 6. 2. Ordinary phosphorus, 9 parts; niter, 14; binoxide of manganese, 14; gum or glue, 16. Melt the glue at 212° Fah., gradually add the phosphorus, which must be well stirred into the liquid; then add the niter and coloring matter. Keep the paste at a regular temperature of about 97° Fah. by means of hot water under the iron or marble slab on which it is spread.

(19) I. L. S. says: Can you give me a process for purifying rancid butter, also best coloring ingredients? A. Use 1 pint of water to each lb. of butter, previously adding 20 grains of chloride of lime to each pint of water; wash well the butter in this mixture, afterward rewash in cold water and salt; or melt the butter in a water bath with animal charcoal, coarsely powdered and previously well sifted to free it from dust; skim, remove and strain through flannel, then salt. For coloring, a solution of annatto is commonly used.

(20) J. H. P. asks; 1. What is the meaning of the term "pitch," when applied to propellers or screws? A. The pitch is the distance the screw would advance in one revolution, if it worked in an unyielding medium, after the manner of a screw in a nut. 2. In describing steamship engines, why is it said that the nominal horse power is, say, 500, but will work up to, say, 2,500 horse power? A. The term nominal horse power is merely a commercial unit, and the expression you quote has about the same significance as if it were said that the vessel has a No. 8 engine, which is capable of developing 2,500 indicated horse power.

(21) F. C. S. says: A master mechanic here claims that the proper manner to get the length of an eccentric rod, in case an engine came in with a broken one, is to get the length from center of driving shaft to center of knuckle on link where eccentric rod connects and from this length take the distance from center of eccentric to end of lugs on eccentric straps where the rod is bolted; the remaining length, he claims, equals the length of eccentric rod. Please give the correct way for ascertaining the length under the stated circumstances? A. As you state the rule, it is incorrect. A good way to find the length, is to place the crank on the two centers alternately, and find the length that will divide the lead, or nearly so. This supposes that the eccentric is secured in the proper position. If not, it is first to be adjusted.

(22) Constant reader inquires the amount of upward pressure exerted on the sides of a coffer dam by the surrounding waters, the interior being pumped out to bottom; not taking into account the laying of the timbers composing the dam? A. It is equal to the weight of a volume of water equal to the volume of the submerged part of the coffer dam, or, more simply, the weight of the water displaced,

(23) A. B. C. asks: 1. Why is it claimed for compound engines, that the strains are more regular? It is asserted that the strains are not so irregular as in the simple engine. If the initial pressure in the high press cylinder is expanded into a large cylinder, before the high press piston has completed its stroke, is not the steam expanded, the pressure reduced, and as a consequence the strains as irregular as before? A. If you compare a simple engine with a compound, both working at a high rate of expansion, you will see that the range of expansion in the single cylinder is much greater than in each of the two or three cylinders of the compound engines. The equalization of strains on the crank pin is effected by special arrangement of the cylinders, and this can be done either with compound cylinders or several simple ones. 2. Again, in regard to high pressure boilers, the strength of a cylinder is inversely as its diameter and inversely as its length. Please state where the limit is. I read in the *Engineer* that the tubulous boiler was the only style now known where the pressure could be safely carried at 150 to 160, that is, for sea-going ships. The Mississippi river boats carry 175 to 200 lbs. pressure per square inch; why could not they be used on marine vessels? A. This refers to cylinders exposed to external pressure. In practice the limit of length is a few feet, the internal flues being divided in effect into a series of short cylinders by attaching rings or bands. The tubular boiler is used in marine practice instead of the style with flues commonly found in western steamers, for the reason that it occupies less space and weighs less for the same capacity and economy.

(24) F. M. D. says: I am going to use a composition in my steam boiler to remove incrustation and keep the boiler clean. It is composed of 10 lbs. of soda ash, 1 lb. of muriatic acid, ½ lb. of acetic acid, and 2 lbs. of chestnut oak bark. Will this be injurious to the iron if used regularly, and if so, state which of these articles cause injury? A. Omit everything from the composition except the soda ash.

(25) W. P. says: I am working at an altitude of 10,500 feet, where it is impossible for a pump to draw more than 18 or 20 feet perpendicular, consequently losing 5 lbs. per square inch of pressure on the valves owing to the rarefied condition of the air. Now what I wish to know is this. Does not a steam gauge manufactured in Chicago or Boston, or any other city of the same altitude, mark 5 lbs. light when on a boiler up in this altitude, or say 55 lbs. when there are actually 60 in boiler? By figuring out the safety valve I find such to be the case, or the steam gauge is incorrect. A. The ordinary gauge, when correctly adjusted, shows the pressure in the boiler above the atmosphere. To get the absolute pressure, the pressure of the atmosphere, as obtained from a barometric observation, must be added. We would be glad to have complete dimensions of your safety valve, with weights of the various parts, and the conditions under which the discrepancy between the gauge and valve was noted.

(26) H. C. inquires whether the whole length of the tube, or only that part surrounded by water, is reckoned as heating surface in an ordinary upright boiler? A. In a boiler, all surface that has fire or hot gas on one side and water on the other, is reckoned as water-heating surface. Surface with hot gas on one side and steam on the other is called superheating surface.

(27) A. E. R. asks: 1. Is a hot water boiler test less hurtful to the boiler than a cold water test? If so, why? A. A hot water test is generally less injurious to a boiler than a test with cold water, for the reason that the boiler if tested cold is subjected to strains that do not occur in its practical use. 2. Is there an inspector of boilers in New York State now, and how often does the law require a boiler to be inspected? A. We think not.

(28) C. T. asks: Can an engine run as fast on the level with 100 lbs. steam, as it can with 150 lbs., no load attached to take the steam? A. If the question refers to a locomotive running light, as seems probable, the speed will be greater with the higher pressure if the pipes and ports are sufficiently large.

(29) F. C. S. asks how in drawing an engine with inclined cylinder is the end of the end of the cylinder in top view projected from side view. Four points I can get easy enough, but how can I get more? A. You can find additional points in a similar manner to the first four, by noting where perpendiculars from certain elements or lines parallel to the axis in the side view cut the corresponding elements in the top view.

How many feet a minute can a plunger pump be run to work well? A. The speed of pump is governed by the size of plunger or suction pipe, noting that for ordinary lengths of suction pipe, the velocity of the water should not exceed 600 feet per minute, which figure can be used for a first class pump.

(30) P. B. asks: What does the Post Office department desire for an invention for cancelling postage stamps? A. A canceller is desired which shall be

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rapid in application, needs no special skill for its use, and which shall act on the stamp in such a manner that it cannot possibly be used again.

Will it require more power to drive a Sturtevant blower with its mouth closed than when open? A. Quite the contrary.

(31) S. L. B. asks: What chemical or compound can I use to remove entirely the paper clippings from the pages of an account book, without injuring the paper underneath or defacing the writing thereon? The pasting has been done with mucilage. A. Water is the only remedy; use warm water applied with a clean soft sponge. The sponge should not be too wet, and the scraps should not be removed until the gum is thoroughly softened. With care the scraps may be removed and the greater part of the adhering gum sponged from the pages without injuring the legibility of the writing. A good bookbinder could perhaps perform the work more skillfully.

(32) A. A. F. asks whether glue, starch, or other sticky substance can be made to evaporate, and rise as steam, and act on an article the same as if it had been dipped in the liquid? A. No.

(33) F. P. M. asks: Do you know of anything that will make the beard grow? I would like to grow a beard so as to cover eruptions which have disfigured my face for seven years. A. The expressed juice of raw onions, applied frequently to the parts requiring it, is said to have notable power in restoring the tone of the skin and stimulating the capillary vessels. Considerable efficacy in this respect is also attributed to the oil of myrtle berries, vinegar of cantharides, and petroleum. The repute of these "invigorators" is, however, much greater than their efficacy. Wilson's "invigorator" consists of cologne water, 2 ozs.; tincture of cantharides, 2 drachms; perfumed with a few drops of oil of lavender and rosemary. According to the directions it is to be applied twice a day. If the skin becomes sore it must be discontinued, or used at longer intervals. Weakness of the capillary vessels is usually due to constitutional disorders, and these must first be corrected through the blood. The proper remedies can best be prescribed by a good physician made acquainted with the nature and causes of the affection. A continuance of temperate living, with wholesome food, plenty of exercise, and due regard for sanitary laws, is generally the most reliable invigorator of all the bodily functions.

(34) J. S. B. says: From ill health a great part of my hair and beard has fallen off. Can you suggest any good preparation for restoring or invigorating the hair? A. See answer to F. P. M.

(35) Anxiety asks (1) how the bronze powder for gilding is made? A. Melt together in a crucible over a clear fire equal parts of sulphur and white oxide of tin; keep them stirred with the stem of a glass rod till they assume the appearance of a flaky yellow powder. 2. What is the best way to apply it to glass, so that it will stick? A. Use gold size. 3 How can I prevent the blackening or discoloration of the powder? A. Cover with a coat of clear varnish.

(36) H. W, says: Will you please tell me briefly the best general plan for the construction of a cemetery tomb, more particularly adapted to the purposes of a receiving tomb? A. Make it of stones laid in hydraulic cement, with a floor either of cement or stone, and arching the roof. The door may be of iron. Parties building a dam say that wood kept saturated with water will not decay. Others contend that it must be submerged in order to prevent it. Which is right? A. Both parties may be correct, in a measure, since it is uncertain whether the timber will be continually saturated unless it is submerged.

(37) F.F.W. asks: How can I tell the weight of a cast iron ball of any size without weighing it? A. Multiply the volume by the specific gravity, which for cast iron is 7·207.

(38) H. C. asks for a simple recipe to cure small skins (say squirrel skins) with the fur on, so as to prevent the fur coming out? A. After having cut off the useless parts, soak the skin, remove the fatty matter, and soak in warm water for 1 hour. Mix to a thin paste ½ oz. each of borax, saltpeter, and sulphate of soda. Apply this to the skin and let the latter stand for 24 hours. Wash clean, then apply a mixture of 1 oz. sal soda, ½ oz. borax, 2 ozs. hard white soap melted together without being allowed to boil. Put away again for 24 hours in a warm place. After this dissolve 4 ozs. alum, 8 ozs. salt, and 2 ozs. saleratus in sufficient hot rain water to saturate the skin; then wring out and hang it up to dry. When dry repeat the soaking and drying 2 or 3 times until the skin is sufficiently soft. Lastly smooth the inside with fine sandpaper and pumicestone.

(39) J. H. L. informs C. H. C. that he can remove the unpleasant taste of cement from his cistern water by simply coating the entire interior of his cistern with common tallow, The tallow will prevent the water coming in contact with the cement, while at the same time it will not impart any flavor to the water.

(40) J. T. T. says that A. B. M. can drill his watch crystal by grinding a rat tail file, three square, and making the point a long thin taper, and use spirits of turpentine; he must be gentle with it when the point just pricks through. After a hole is made, however small, it may be easily rimmed out to any size.

(41) M. H. says: I am manufacturing artificial stone and find it takes water freely. Will you give me some recipe for a wash that will make them waterproof without discoloring the stone, also that will not damage the formation? A. Apply soluble glass.

(42) W. A. D. asks: What angle (if any) should the under side of the teeth of an upright mill saw make with a horizontal line, that is, with the horizontal surface the teeth are cutting? A. It depends upon the hardness or softness of the wood.

(43) F. B. S. W. asks for a recipe for making plug tobacco? A. Strip the tobacco, sprinkle the leaves with a liquor of white sugar, black licorice, and water; make into rolls, and while moist press flat in moulds.

(44) J. H. F. asks: How can I repair small holes in rubber boots? A. By rubber cement composed of india rubber dissolved in benzole, or by attaching thin pieces of gutta percha rendered plastic by immersion in boiling water.

How can I prevent brown linen from shrinking? A. We know of no process.

How can I exterminate those microscopic pests, emmets, which infest many houses during warm weather? A. Sprigs of wormwood or wintergreen strewed around the house are said to be efficacious.

(45) S. B. G. asks: Why are the upper regions of the air colder than the lower? A. Because the heat radiated from the earth warms the atmosphere nearest the earth's surface.

(46) C. A. R. asks: How is a dispatch received from the Atlantic cable? A. Either by reflecting galvanometer or siphon recorder. In the first a delicate magnet carries a small mirror from which a beam of light is reflected, and caused by its motion to make signals indicating letters. Thompson's siphon recorder has been used on the French Atlantic cable. The current from the cable passes into a coil of wire suspended between the poles of magnets. The coil turns round in a direction depending upon the direction of the current. The motion of the coil is communicated to a glass siphon which feeds itself with ink from a basin. The ink is electrified and spurts out against a strip of paper and draws an undulating curve, which indicates the letters of the message.

(47) I. H. asks: 1. How is a staff fastened so as to turn a pivot on it in a common Swiss bow lathe? A. One end is put on the live center of the lathe, the other is held in a steady rest. 2. What are the uses of the centers, and does there not come a chuck with the same? A. The centers are to hold ordinary work. A chuck is necessary to drive the work and usually comes with the lathe.

(48) R. K. says: In overhauling locomotives of different kinds, I find trouble sometimes in telling iron from steel in casehardened work, such as links, pins, etc. Can you tell me how to tell the one from the other? A. You will find in casehardened iron small black marks or streaks that do not exist in steel.

(49) O. A. says: 1. I am making castings that weigh about 6 lbs., and they have to be finished all over. I cannot get the cope sound. A. Prick the mould all over with a fine wire, which will let off the air and gas more freely. Make heavier and taller gates, and if necessary dry the mould. 2. Does the quality of pig and scrap iron make any difference, providing it makes soft castings? A. No.

(50) M. A. B. says: 1. I wish to make a flywheel for a lathe by taking a light iron wheel and casting on a heavy rim of cement. What kind of a composition would you recommend? A. Use lead. 2. Could I use a mould made of wood well painted on inside? A. Yes.

(51) C. L. A. asks: What is meant by carbon points used for electric light? What are they composed of? A. They are long rods, cylindrical or square-usually about ⅜ of an inch thick, made of carbon obtained from incrustations formed on the hottest parts of the interior surfaces of gas retorts, or from the dust of coke mixed with gas tar, forced into moulds and carbonized in a muffle. The former material is the best, as it burns with great difficulty and is very compact and hard.

(52) J. Valiant asks: How can I prevent blackness when plating gold chains with a solution of chloride gold and hyposulphite soda? A. The blackening is due to the presence of sulphides in solution. The only remedy is to give the work a slight covering of copper (electro deposit) or to use a different bath. The double cyanide gives the best results.

(53) J. H. asks: How is it that gas after it becomes inflamed in safety or Davy lamps cannot escape to inflame the gas outside of the lamp? And also why does the lamp burst after the wire is red hot, or what causes the expansion? A. It is because the metal conducts away the heat so rapidly that the temperature of the gas in contact with it is reduced below the point of ignition. If the gauze becomes sufficiently heated the flame will pass. Depress a piece of fine wire gauze over a clean flame and the same phenomenon will be noticed.

(54) E. S. asks: How is the crystalline surface produced on tin plate? A. Make a mixture of 3 parts hydrochloric and 1 part of nitric acid, and dilute with an equal volume of water. It is merely necessary to immerse the plates in this bath for a period not exceeding ten seconds, the plate afterwards to be thoroughly washed with water and dried in sawdust.

(55) A. S. M. asks: Can you give me a recipe for making imitation shellac varnish? A. The following article under this name is used by furniture dealers: Gum sandarac, 1½ lbs.; pale rosin, 1½ lbs.; benzine, 2 gallons. Dissolve by gentle heat. The varnish is quick drying.

(56) R. P. M. asks: What is the solution for bichromate battery known as Allen's crystal, and how can I prepare it? A. We do not know of a solution by this name. The usual fluids for this battery are, for the porous cup, a strong solution of bichromate of potash mixed with about ⅛ part of strong sulphuric acid; for the outer solution, water acidulated with $\frac{1}{10}$ part oil of vitriol or 15 per cent of zinc sulphate.

Minerals, etc.—Specimens have been received from the following correspondents, and examined, with the results stated:

J. W. H.—No. 1 is traprock and felspar. No. 2 is a semi-decomposed gneissoid rock with hornblende. No. 3 is hornblende. No. 4 is hornblende schist. Nos. 6 and 8 are limestone and serpentine. No. 10 is felspar and willemite. No. 12 is serpentine. No. 13 is sandstone and chlorite. No. 14 is impure hematite. No. 15 is albite—lime orthoclase. The missing numbers were not in the box.—J. J. P.—It is flint containing small specks of iron pyrites—of no value.—E. P.—The sample of lime appears to be of good quality. It will answer for the light, but must be kept away from the air. A preserve jar will answer.—J. J. E.—It is nodular iron pyrites—sulphide of iron. You will find an article on the subject on p. 7, vol. 36.—J. G. P.—No. 1 is a trap rock containing calcite—lime carbonate, gypsum—lime sulphate, and ferruginous earths. No. 2 contains hornblende, lime carbonate, iron oxide, and pyrites—iron sulphide. No. 3 is an impure talcose schist.

COMMUNICATIONS RECEIVED.

The Editor of the Scientific American acknowledges, with much pleasure, the receipt of original papers and contributions upon the following subjects:

On the Effect of Wind on Unfinished Buildings. By W. W.

On a Curiously Marked Stone. By H. L. C.

On the Composition of Patent Medicines. By V. N., M. D.

On the Relative Cost of Coal and Coaldust Fuels. By W. F. S.

HINTS TO CORRESPONDENTS.

We renew our request that correspondents, in referring to former answers or articles, will be kind enough to name the date of the paper and the page, or the number of the question.

Correspondents whose inquiries fail to appear should repeat them. If not then published, they may conclude that, for good reasons, the Editor declines them. The address of the writer should always be given.

Inquiries relating to patents, or to the patentability of inventions, assignments, etc., will not be published here. All such questions, when initials only are given, are thrown into the waste basket, as it would fill half of our paper to print them all; but we generally take pleasure in answering briefly by mail, if the writer's address is given.

Hundreds of inquiries analogous to the following are sent: "Who makes small tubular boilers for steam launches? Where can I purchase aluminum?" All such personal inquiries are printed, as will be observed, in the column of "Business and Personal," which is specially set apart for that purpose, subject to the charge mentioned at the head of that column. Almost any desired information can in this way be expeditiously obtained.

OFFICIAL.

INDEX OF INVENTIONS

FOR WHICH

Letters Patent of the United States were Granted in the Week Ending

October 9 1877,

AND EACH BEARING THAT DATE.

[Those marked (r) are reissued patents.]

A complete copy of any patent in the annexed list including both the specifications and drawings, will be furnished from this office for one dollar. In ordering, please state the number and date of the patent desired, and remit to Munn & Co., 37 Park Row, New York city.

Alum, manufacture of, G. P. Rockwell	196,043
Ammonia salts, treating gas liquor for, L. S. Fales	195,998
Barrel holder and skid, G. W. Brown	195,916
Bee hive, J. C. Train	196,060
Beer measure gage, Cave & Nicholson	195,980
Boat knee, D. True	195,908
Boots and shoes, protector for, C. Nobs	195,943
Boots and shoes, insoles for, A. M. Daniels	195,886
Bottle stopper and fastening, H. B. Anderson	195,970
Box wood and coal, A. Stautz	196,052
Brake, car, J. H. Lakin	195,935
Brake, car, Seevers & Jelfs	196,047
Brick kiln, J. H. Kelley	195,895
Brick machine, W. E. Gard	195,923
Broiler, O. Edwards	195,995
Bung, F. W. Robertshaw	196,042
Burglar alarm, W. H. Knowles, Jr	196,023
Burglar alarm, F. Krupp	195,934
Burglar alarm, W. N. Patteson	195,946
Butter package, J. F. Bly	195,976
Butter package, G. Kator	195,931
Button fastening, J. J. Mervesp	195,899
Button, sleeve, A. L. Frankenthal	196,001
Can, milk, G. H. Lester	195,896
Can, shipping, J. C. Moore	195,942
Cane, walking, J. Pool	195,949
Car, ballast distributing, A. B. Dockstader	195,919
Car coupling, C. W. Stimpson, Jr	195,964
Car, locomotive street, H. C. Bull	195,881
Car mover, A. Lebus	195,936
Car, railway ferry, P. P. Shelby	195,957
Car starter, Crocker & Lytle	195,987
Cars, distributing grain in loading, J. Jackson	195,893
Cars, drawbar for railway, J. B. Baugh	195,971
Carding engines, stopping rolls of, C. H. Chapman	195,982
Carriage top, P. Copeland	195,986
Caster, furniture, E. Hoffstaetter	196,017
Caster, furniture, S. Konz	196,024
Chair bottoms, cutting veneers for, O. N. Eaton	195,921
Chair, opera, P. W. Nolan	196,036
Chair seats, Provenzano & De Gaetano	195,951
Churn, W. F. Long	196,029
Cigar holder, C. Brinker	195,973
Cigar lighter, H. R. Whiteman	196,062
Clamp, M. L. Edwards	195,994
Comb, semicircular, E. W. Smith	196,960
Corset, W. S. & C. F. Hunt	196,020
Corset, skirt-supporting, C. A. Griswold (r)	7,908
Cotton and hay press, B. J. Methvin	196,032
Cotton batting folding machine, R. Catlow	195,884
Cotton seed, obtaining fiber from, W. Adamson	195,969
Countersink, D. F. Barber	195,877
Cow fetter, A. R. Gillis	196,008
Crayon, O. Swasey	196,054
Crucibles, compound for, R. W. Wallace	196,061
Cultivator, J. S. Butterfield	165,979
Curtain roller and bracket, H. C. Steinhoff	195,962
Dish, pressed wooden, G. Gardner	196,005
Ditches, forming and lining, J. P. Culver	195,989
Douche, G. M. Smyser	196,050
Drafting apparatus for dresses, C. H. Griffin	195,926
Drawing board, T. Bergner	195,915
Drill chuck, C. Elterich	195,997
Drills, machine for clearing twist, G. R. Stetson	195,963
Drilling machine metal, M. L. Edwards	195,993
Eaves trough machine, W. J. Barber	195,914
Feather renovator, J. J. Van Alstine	195,968
Feed water heater and feeder, G. H. Burroughs	195,975
Feed water heater, etc., Hermans & Smith	196,013
Fence, portable, A. S. Chaney	195,981
Fence, post, J. W. Frey	196,003
Fence stretcher, wire, H. Schulgen	195,955
Fertilizer distributer, J. G. Sims	195,959
Fire extinguisher, C. W. Talcott	196,055
Fire extinguisher, car, Hotchkiss & Pegram	195,892
Fire kindler, J. A. Conover	195,985
Floor for buildings, fireproof, Egan & Hill	195,996
Fruit dryer, W. S. Plummer	195,948
Gas cock, automatic, C. H. Seofield	195,905
Gate, L. C. Beckford	195,972
Grain separator, J. M. F. Shepler	195,958
Grate bar, O. J. Hodge	195,015
Grinding machine, H. Wickham, Jr	196,063
Ground, holder for articles being, J. Jowitt	195,930
Gun barrels, machine for boring, H. C. Bull	195,882
Harness, J. H. Nichols	196,035
Harness loop, W. Courtenay	195,885
Harrow and corn marker, L. Davis	195,991
Hides and skins, treating, J. Fishback	195,999
Hose reel and carriage, C. L. Fitch	195,922
Hydrant and hose plug, G. W. Lutz	195,937
Hydrant, fire, J. Flower	196,000
Key boards, smoothing ivory, M. Pratt	195,902
Knitting machine take-up, J. S. Crane	195,917
Knitting machine take-up, G. Jackson	195,929
Knob for doors, etc, S. Hiler	196,014
Lamp, night, M. S. Chase	195,983
Lantern, carriage, F. Park	195,945
Lenses, measurement of, Lomb & Scharpf	196,028
Letting off mechanism, J. P. Buzzell	195,883
Lifting jack, R. Hermance	195,927
Lubricating compound, B. French	195,890
Mail bag catch, G. F. Shaver	195,956
Mantel, iron, T., J. M. & T. E. Scantlin	195,903
Marble, etc., artificial, W. Dwight	195,920
Match safe, Hubbell & Ochs	195,928
Mill spindles, attachment to, C. F. Walters	195,910
Moulding metal, core for, R. C. Totten	195,966
Monument and tomb, combined, G. D. Schuyler	196,045
Mower, R. D. Thomson	195,907
Mucilage bottle, F. Sholes	196,049
Music, apparatus for setting up, H. Goodwin	195,924
Muzzle, calf, G. Tilton	196,058
Necktie, W. H. Hart, Jr. (r)	7,909
Nut-lock, J. J. Winsor	195,912
Nut-lock for fish bars on railways, L. S. Brown	195,880
Oakum, machine for making, D. S. Tibbals	196,059
Ore-roasting furnace, W. J. Taylor	196,056
Ore stamp feeder, J. Tullock (r)	7,906
Overalls, S. Kauffmann	195,894
Paper, folding and cutting, G. E. Jones	196,021
Paper box, A. D. Schaeffer	195,904
Pen, fountain, J. W. Stanton	196,051
Pencil, copying, C. Walpuski (r)	7,907, 9,708
Piano keys, dressing, Wilder & McNeil	195,911
Picture exhibitor, W. H. Lewis	196,027
Pictures, stereoscopic, H. A. Reynolds (r)	7,905
Piles and timber, preserving, J. P. Culver	195,990
Plant and tree protector, J. O. Antisdale	195,913
Planter, corn, W. Galley	196,004
Planter, corn, G. D. Haworth	196,012
Plow, W. S. Lawrence	196,026
Plow, F. E. Sessions	196,048
Plow, sulky, W. K. & D. Bushnell	195,977
Postal card, F. W. Brooks	195,974
Printing press, J. O. Kurtzmann	196,025
Pulverizing mill, I. M. Phelps	195,039
Pump bucket, W. D. Mayfield	196,031
Pump, force, W. S. Laney	195,897
Punch, ticket, J. B. Aiken	195,876
Rail joints, bolt lock for, A. A. Wilder	196,064
Railroad signal, pneumatic, Kettell & Howland	195,022
Rivers, deepening bars of, H. F. Knapp	185,896
Rockets, J. H. S. Hooper	196,019
Rod coupling, T. D. Culter	195,988
Rotary engine, A. F. W. Partz	196,038
Ruling machine, paper, J. T. F. MacDonnell	195,988
Safe, marine, T. F. Rowland	195,954
Safety pins, making, Butler & Wellge	195,978
Sash holder, V. Freeman	196,002
Sewing machine, T. A. Macaulay	195,939
Sewing machine feeding mechanism, T. K. Keith	195,932
Sewing machine shuttle, T. J. Holton	196,018
Sewing machine shuttle, H. J. Nott	195,944
Sheep to be sheared, securing, W. M. G. Turquand	195,967
Shingle sawing machine, W. J. Perkins	195,900
Shirt, A. L. Edwards	195,992
Shoes, exhibiting, J. S. Palmer	196,037
Shutter fastening, Booth & Wyatt	195,879
Sink trap, H. Miller	196,033
Spinning frame, ring, G. Draper	195,887
Spinning machinery, J. M. Stone	195,906
Sprinkler, street, J. Hoffman	196,016
Square, dressmaker's, C. H. Griffin	195,925
Steam ejector, F. Steele	196,053
Steam trap, W. Conner	195,984
Steam trap, T. Kieley	195,933
Steel, manufacture of, M. J. Hamilton	195,891
Stove, coal oil, W. S. Potwin	195,950
Stove grate, H. Cribben	195,918
Stove heating, T. Gemmell	196,007
Stoves, conductor for cooking, C. H. Phelps	195,901
Surgeons' bandages, fabric for, H. P. Plante	196,040
Surgical apparatus, B. G. McCabe	195,941
Syringe bottle, hypodermic, E. Pfarre	195,947
Telegraph, quadruplex, B. Thompson	196,057
Thill coupling, Spencer & Barrett	195,961
Trace carrier, L. E. Walker	195,909
Trunk fastener, P. Martin	195,030
Tobacco, treating leaf, C. F. Bjick	195,878
Toilet case, W. A. Nichols	196,034
Toy, automatic, J. Schwippl	196,046
Toy money box, J. Hall (r)	7,904
Umbrella runner, C. Harrison	195,010
Umbrella tip cup, B. J. Riley	195,952
Vault cover and railing, C. H. Straight	195,965
Vegetable cutter, M. Roos	196,044
Vehicle spring seat, R. Dudley	195,888
Wagon, side bar, J. H. Robinson	196,041
Washing machine, L. Rivers	195,953
Well-boring apparatus, Haas & Manning	196,009
Whiffletree, etc., connecting link, G. W. Martin	195,940
Window cleaner, W. C. Gayton	196,006
Wool, treating artificial, A. D. Elbers	195,889
Yoke, neck, H. H. Hartzell	196,011

DESIGNS PATENTED.

10,270.—Burial Caskets.—Augustus Clark, Amsterdam, N. Y.

10,271.—Wall Pocket Pattern.—William Hamilton New York city.

10,272 and 10,273.—Oil Cloths.—C. T. Meyer and V. E. Meyer, Bergen, N. J.

[A copy of any of the above patents may be had by remitting one dollar to Munn & Co., 37 Park Row, New York city.]

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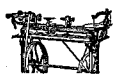

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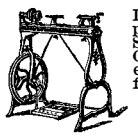

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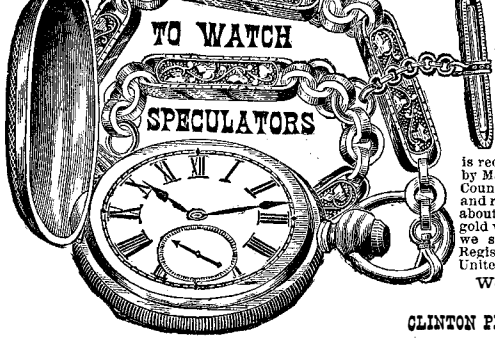

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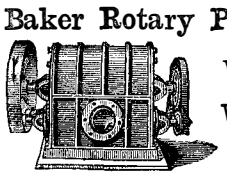

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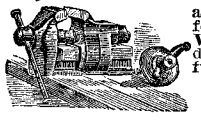

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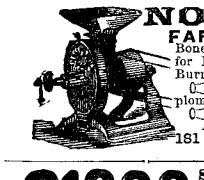

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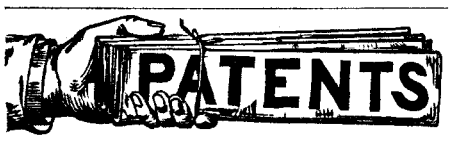

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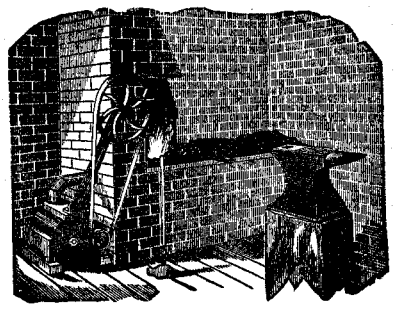

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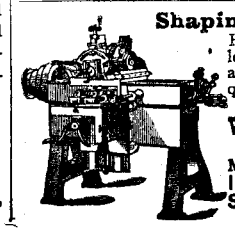

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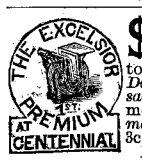

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